A330
TECHNICAL TRAINING MANUAL
MECHANICAL & AVIONICS COURSE - T1+T2 (LVL 2&3)
(RR Trent 700)
NAVIGATION

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G9409341 - GAUT0T0

NAVIGATION LINE MAINTENANCE BRIEFING (2)

GENERAL

The Air Data and Inertial Reference System (ADIRS) is composed of three identical Air Data and Inertial Reference Units (ADIRUs), one ADIRS Mode Selector Unit (ADIRS MSU) and several sensors. The ADIRUs receive information from the sensors in order to compute air and internal laser gyros and accelerometers to compute inertial data. This data is displayed to the crew and sent to the MCDU and other A/C systems. The sensors also send information to the Integrated Standby Instrument System (ISIS) for standby display.

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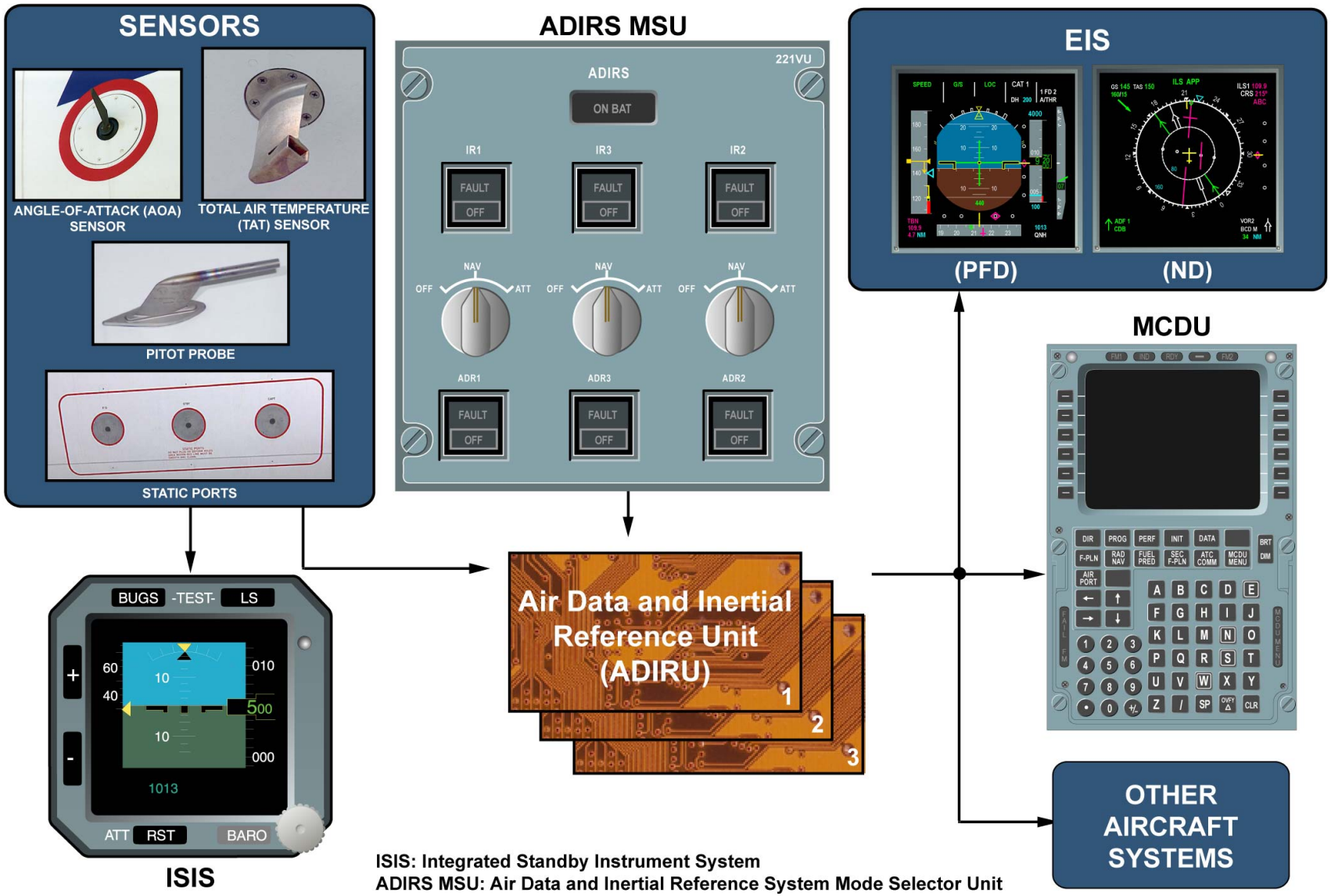

ISIS: Integrated Standby Instrument System
ADIRS MSU: Air Data and Inertial Reference System Mode Selector Unit

GENERAL

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NAVIGATION LINE MAINTENANCE BRIEFING (2)

ADIRS - ALIGNMENT

BATTERIES TEST

NOTE: Note: There is no specific ADIRS battery.

ALIGNMENT OF THE IRS

The Flight Management Guidance and Envelope System (FMGES) uses the reference point coordinates of the departure airport to align the Inertial Reference System (IRS). It automatically calls these up from the database after the operator has entered a company route or an origin-destination city pair and pressed the ALIGN IRS on the MCDU. The operator can manually adjust these coordinates to the gate position. A complete alignment takes 10 minutes. A specific alignment procedure has to be respected beyond 73°and 82° north or south (to refer to FCOM documentation). The alignment procedure is not possible beyond 82° north or south.

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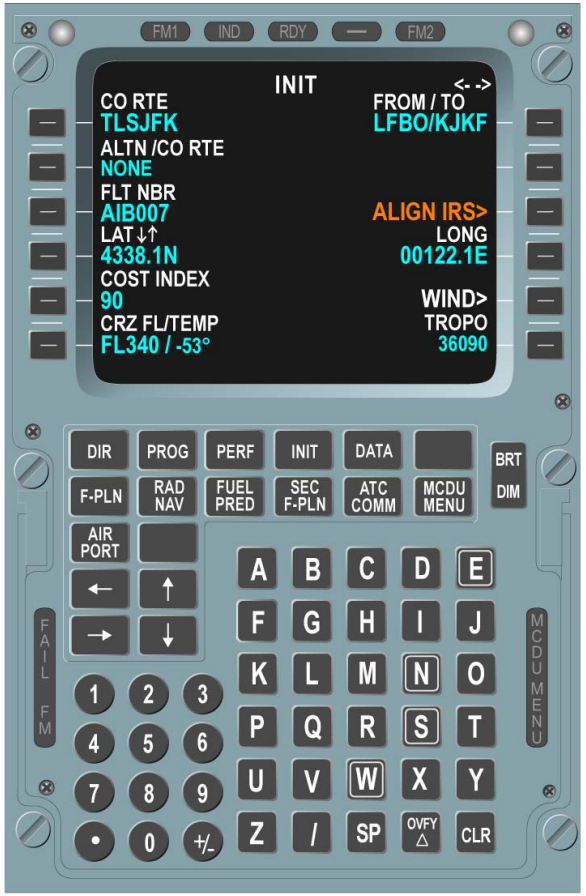
ADIRS MSU

MCDU



Each time a selector is switched to NAV, the ON BAT ligth comes on for a few seconds in order to test the switching to the aircraft batteries.

ADIRS - ALIGNMENT - BATTERIES TEST & ALIGNMENT OF THE IRS

NAVIGATION LINE MAINTENANCE BRIEFING (2)

ADIRS - ALIGNMENT (continued)

AUTOMATIC ALIGNMENT BY GPS (OPTION)

With the latest ADIRUs, an optional automatic alignment by GPS position is possible. This initialization by GPS does not require any operator action. Less than 1 minute after setting the ADIRS to NAV, the INIT page displays the GPS position, without displaying the ALIGN IRS prompt message. The complete alignment will take between 5 and 10 minutes depending on the local latitude and up to 17 minutes between 73°and 82° north or south. If the operator enters a company route, or an origin-destination city pair, the INIT page displays the departure airport reference-point coordinates, and the IRS ALIGN prompt message appears. If the prompt key is not pressed, the ADIRS will be aligned on the GPS position. If the prompt key is pressed the ADIRS will be aligned on the reference point coordinates of the departure airport. The operator can also modify the indicated aircraft position using the MCDU latitude and longitude keys of the INIT page. In that case the ALIGN IRS prompt key will appear and has to be pressed.

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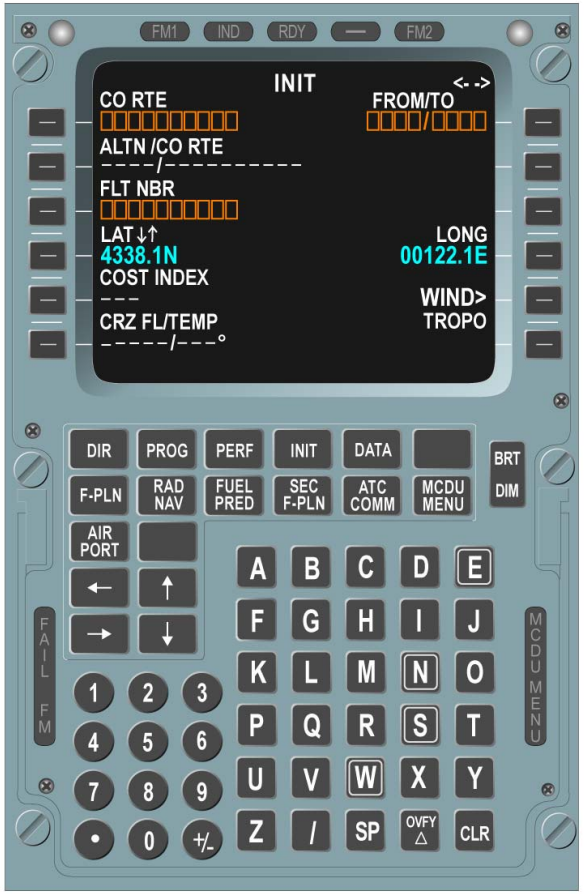
ADIRS MSU

MCDU



Initialization by GPS does not require any operator action on the MCDU.

ADIRS - ALIGNMENT - AUTOMATIC ALIGNMENT BY GPS (OPTION)

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NAVIGATION LINE MAINTENANCE BRIEFING (2)

ADIRS - ALIGNMENT (continued)

FAST REALIGNMENT

During transit or en-route stops with brief ground times, the flight crew may do a fast re-alignment by selecting from NAV to OFF and then back to NAV within 5 seconds. The Inertial Reference (IR) starts a 30 seconds realignment with existing attitude, heading angles and velocities set to zero.

NOTE: Note: The ALIGN IRS prompt will appear and has to be pressed to achieve the alignment. With the optional automatic alignment by GPS, the procedure is the same except that no pilot entry is necessary (no action needed on the ALIGN IRS prompt).

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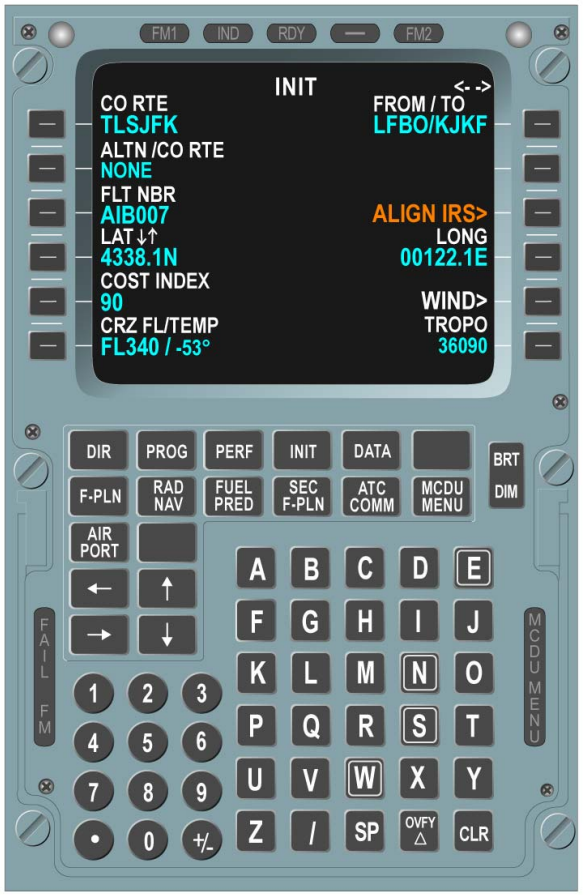

30 seconds fast realignment:
Select NAV to OFF and then back to NAV within 5 seconds.

ADIRS - ALIGNMENT - FAST REALIGNMENT

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NAVIGATION LINE MAINTENANCE BRIEFING (2)

INTERRUPTION DURING ALIGNEMENT

EXCESSIVE MOTION

If taxing or towing causes a step input exceeding a threshold, alignment or rapid realignment is stopped and then the ADIRUs revert to the beginning of a 10 minutes alignment. Step input threshold: 0.5ft/s, 30 seconds after motion has been detected, and no other motion has occurred, a 10 minutes alignment begins.

NOTE: Note: It is not necessary to re-initialize the position if already entered.

TEST OF STORED POSITION

When the initial position is entered, the ADIRUs check if it is within a threshold of the computed position, which has been stored at the last ADIRU shutdown. If not, an MCDU message "REALIGN IRS" is displayed requiring insertion of the present position. Test threshold: 1° for latitude and longitude during alignment, 0.5° during rapid realignment.

NOTE: Note: If the new position does not pass the test, the system waits for another position entry. If the same position (out of the threshold) is entered twice, the ADIRUs accept it as a deliberate choice.

TEST OF COMPUTED LATTITUDE

At the end of the alignment, the ADIRUs check if the entered latitude is within a threshold of the self computed latitude. If not, an MCDU message "REALIGN IRS" is displayed requiring insertion of the present position. At a new position entry, the IRS alignment is necessary. If this position passes the test, the alignment is completed.

NOTE: Note: If the test failed twice, the IRS detects a fault situation (indications on MSU and EWD). In that case, switch the ADIRUs to OFF, wait 20 seconds and try a complete new alignment.

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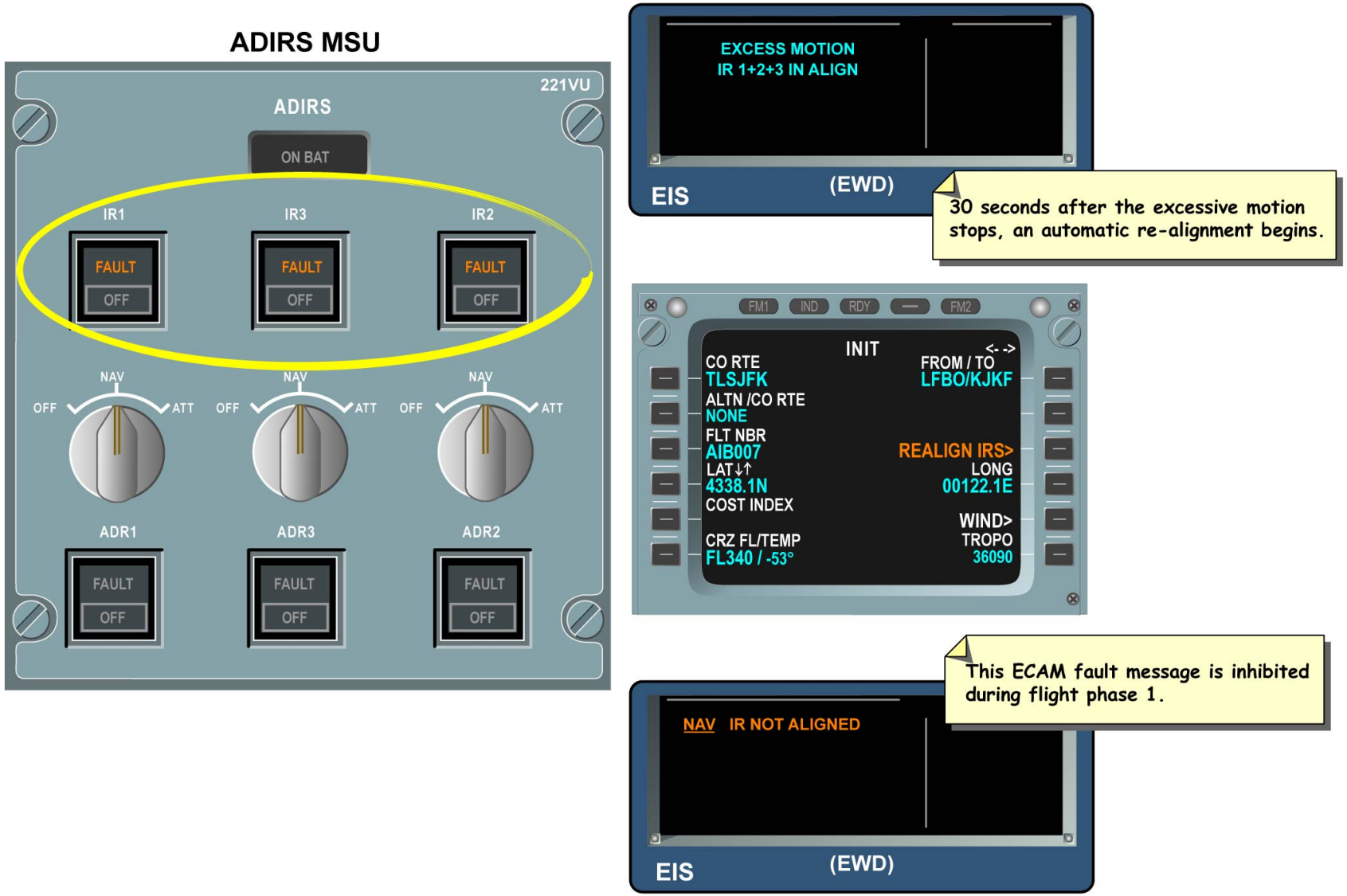

INTERRUPTION DURING ALIGNEMENT - EXCESSIVE MOTION ... TEST OF COMPUTED LATTITUDE

G9409341 - GAUT0T0 - FM34B1000000001

NAVIGATION LINE MAINTENANCE BRIEFING (2)

MAINTENANCE TIPS

In some situations, if you do not know the airport point coordinates, you can waste time aligning the ADIRS and doing the maintenance task. For example, the GPS is not available and you are not at your usual airport. An easy way to retrieve the local data for longitude and latitude (to align the ADIRS) can be to print out the Post Flight Report (PFR). On the PFR header, the origin-destination city pair is normally presented. Take the 4 letters of the destination city and enter them, via the MCDU scratchpad line, both in the "FROM" and "TO" fields of the INIT page, e.g. "LFBO/KJFK". Then press on the ALIGN IRS prompt.

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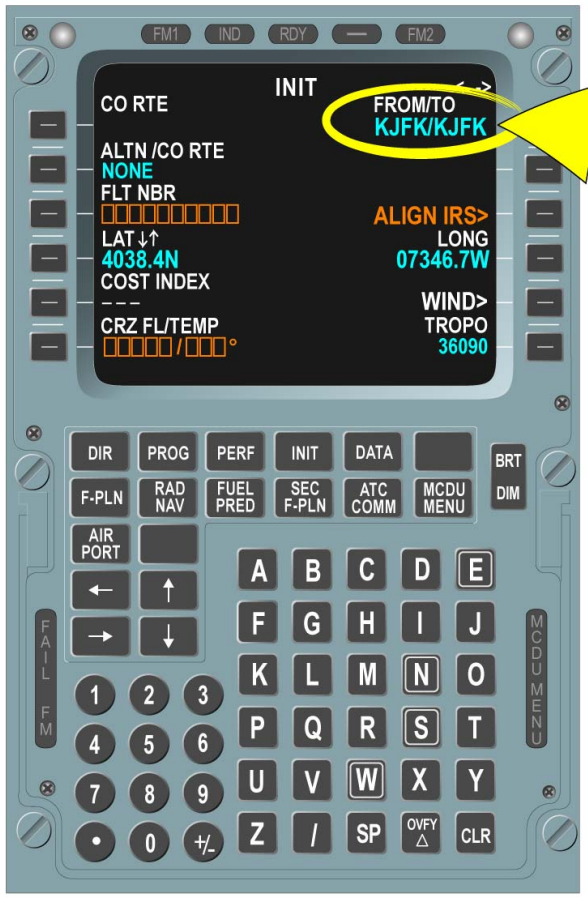
MCDU



A/C IDENT F-GG..M DATE MAR 31 FLT NBR AIB 10.. FROM/TO LFBC/KJFK START/END 0950/18..	MAINTENANCE POST FLIGHT REPORT LEG 00 DB/N 002	CMC1 PRINTING PAGE 01/01 DATE MAR 31 UTC 2000
03 COCKPIT EFFECTS	UTC FLIGHT PHASE	03 FAULTS
ATA 2400 AC BUS 1 FAULT	1020 Taxi Out 03	ATA 245300 Source CBMU Class 1 Hard POWER SUPPLY INTERRUPT AC BUS 1 FAULT

MAINTENANCE TIPS

NAVIGATION LINE MAINTENANCE BRIEFING (2)

ADM PNEUMATIC CONNECTION

To connect the Air Data Module (ADM) quick-disconnect coupling, make sure that you can see the blue ring on the coupling and pull it to make sure that it is correctly attached.

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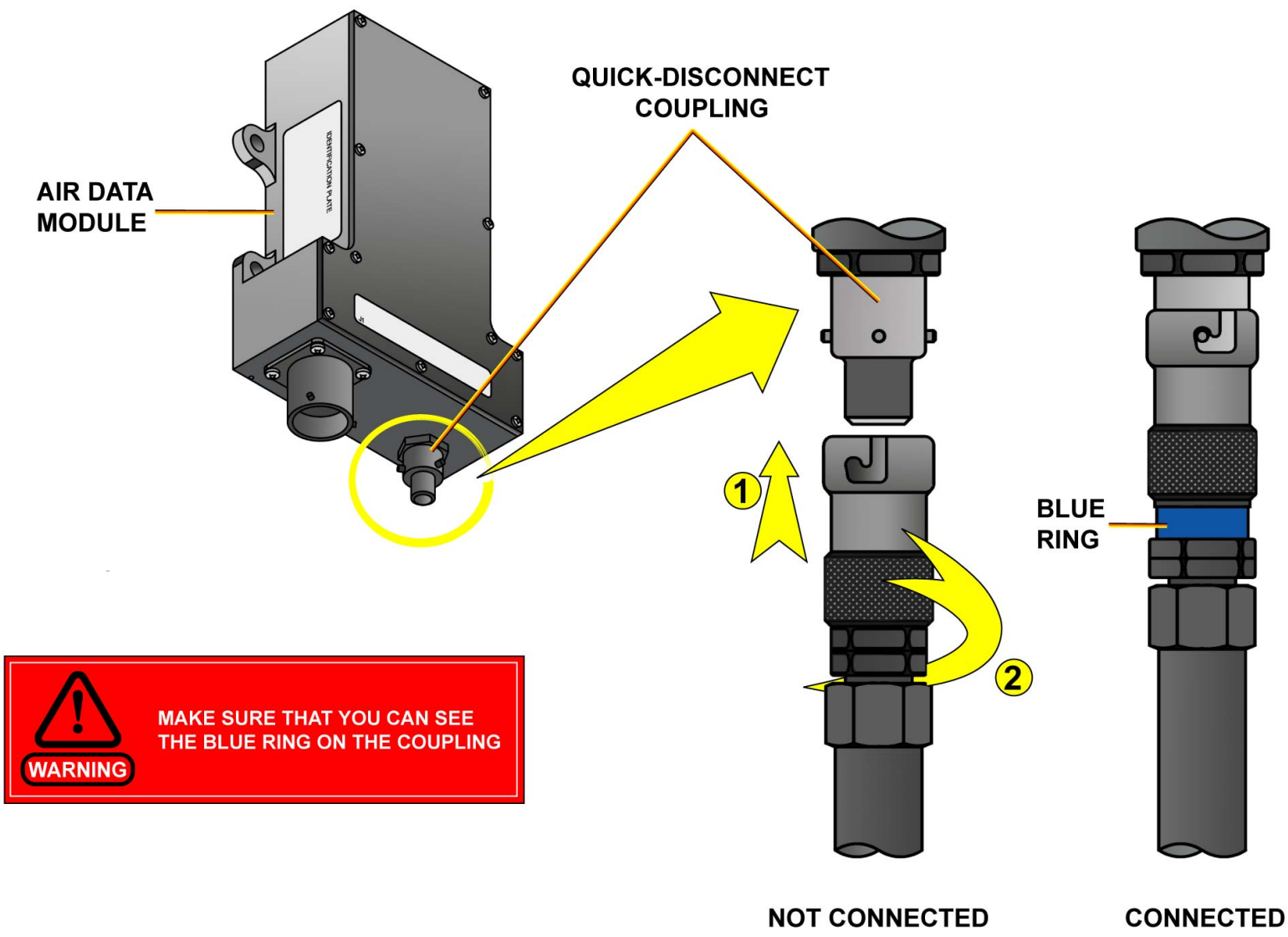

ADM PNEUMATIC CONNECTION

ADIRS & STANDBY INSTRUMENTS GENERAL DESC. (3)

GENERAL

The Air Data and Inertial Reference System (ADIRS) is composed of three identical Air Data and Inertial Reference Units (ADIRUs), one ADIRS Mode Selector Unit (ADIRS MSU) and several sensors. The ADIRUs receive information from the sensors in order to compute air data and internal laser gyros and accelerometers to compute inertial data. This data is displayed to the crew and sent to the MCDU and other aircraft systems. The sensors also send information to the Integrated Standby Instrument System (ISIS) for standby display.

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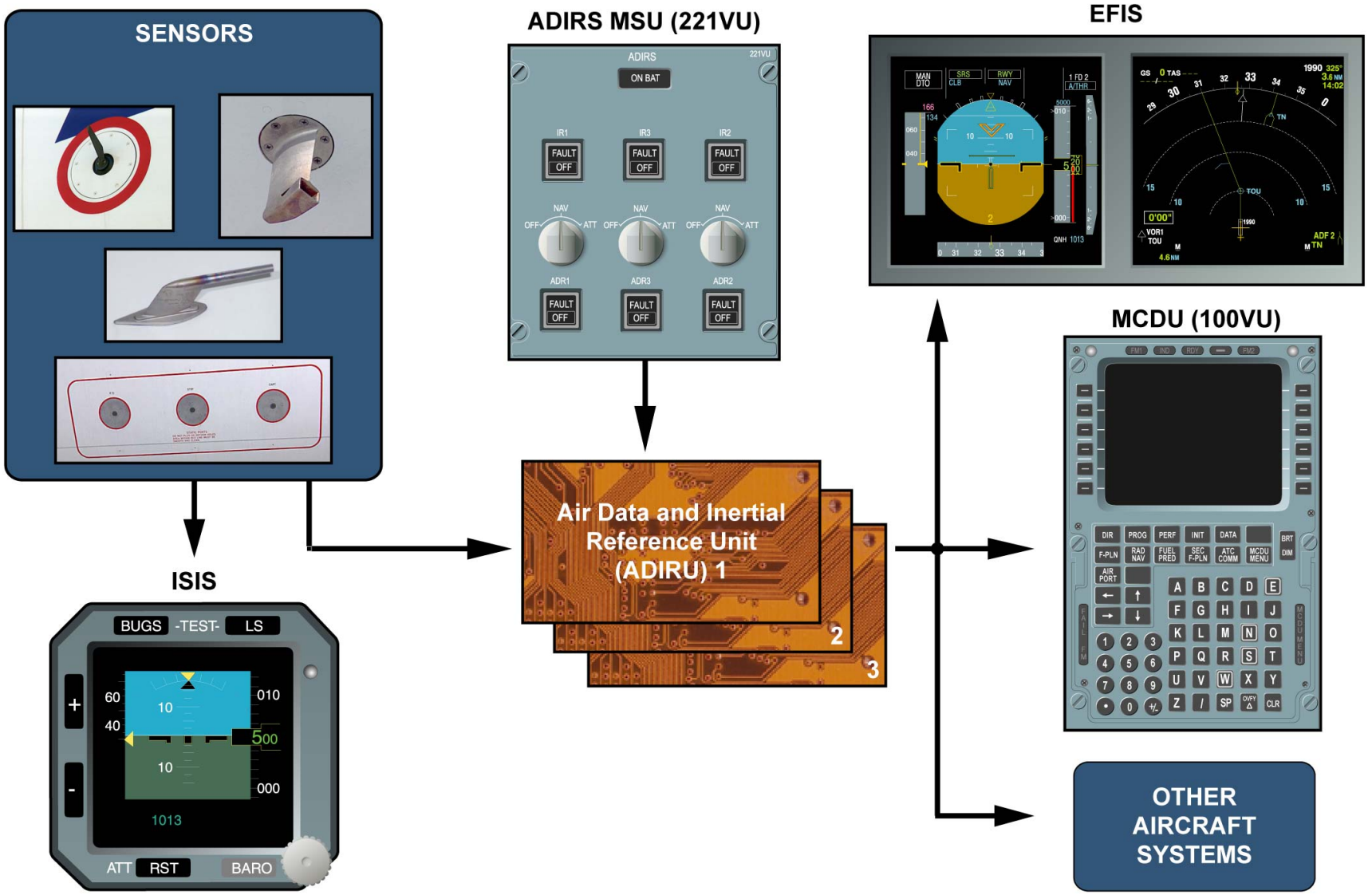
SENSORS
ADIRS MSU (221VU)
ADIRS
ON BAT
IR1
IR3
IR2
FAULT
OFF
NAV
ADR1
ADR3
ADR2
EFIS
MCDU (100VU)
Air Data and Inertial Reference Unit (ADIRU) 1
2
3
ISIS
BUGS
-TEST-
LS
ATT
RST
BARO
OTHER AIRCRAFT SYSTEMS

GENERAL

ADIRS & STANDBY INSTRUMENTS GENERAL DESC. (3)

ADIRS GENERAL

The ADIRUs are used as primary means of navigation. Each ADIRU is a combination of an Air Data Reference (ADR) and an Inertial Reference (IR) inside a single unit.

INPUTS

The ADIRUs receive data from several air data sensors. Pitot and static inputs are processed by Air Data Modules (ADMs) and sent to the ADIRUs, in addition, the information from the Angle Of Attack (AOA) and Total Air Temperature (TAT) sensors send their information directly to the ADIRUs. Standby pitot and static data are also sent to the ISIS. The inertial part of the ADIRUs receives Global Positioning System (GPS) information from the Multi Mode Receiver (MMR). The GPS is optional on the A330/A340-200/300.

COMPUTATION

The ADIRUs inertial part calculates and outputs: attitude, heading, angular rate, acceleration, vertical speed, aircraft position and ground speed. The ADIRUs air data part provides anemometric data such as airspeed, Mach number, static and total temperature, and barometric altitude.

OUTPUTS

The ADIRUs provide information to many of the Line Replaceable Units (LRUs) as well as attitude and heading information displayed on the PFD and ND via the Display Management Computers (DMCs). ADIRU 1 and ADIRU 3 provide heading data to the Digital Distance and Radio Magnetic Indicator (DDRMI).
Displayed heading data is referenced to true or magnetic north, control of the type of output is selectable by the flight crew via the true/MAGnetic pushbutton. The ADIRUs also provide information to the Flight Management Guidance and Envelope Computer (FMGEC) for flight management purposes.

SWITCHING

The ADIRU SWITCHING panel is located on the center pedestal. In normal configuration, ADIRU 1 supplies the CAPT EFIS, and heading to the DDRMI. ADIRU 2 supplies the F/O EFIS and ADIRU 3 is in standby. In case of failure of the ADR or IR function of ADIRU 1 or 2, the affected instruments and displays can be manually switched to ADIRU 3 by turning the switch on the SWITCHING panel.

CONTROLS

The ADIRS MSU is used to turn the ADIRUs on and off. The OFF/NAV/ATT switch controls of the ADIRS MSU allow to power each ADIRU. The ADIRS MSU provides FAULT/OFF indications of the IR and ADR parts of the ADIRUs. It also enables switching from normal operation mode to back-up mode in case of loss of navigation capability. In this case, only attitude and heading information is available.
IRS initialization is normally performed through the FMGEC via the MCDU. The MCDU also displays ADIRS parameters. The Flight Control Unit (FCU) provides the capability of adjusting the barometric reference to the ADIRUs.

NOTE: Note : with the latest version of the Flight Management System (FMS), an auto-alignment by GPS is available.

INTERFACE

The ADIRUs are directly connected to various user systems (Flight Warning Computer (FWC), Full Authority Digital Engine Control (FADEC), DDRMI), and to the Flight Control Computers (FCCs).

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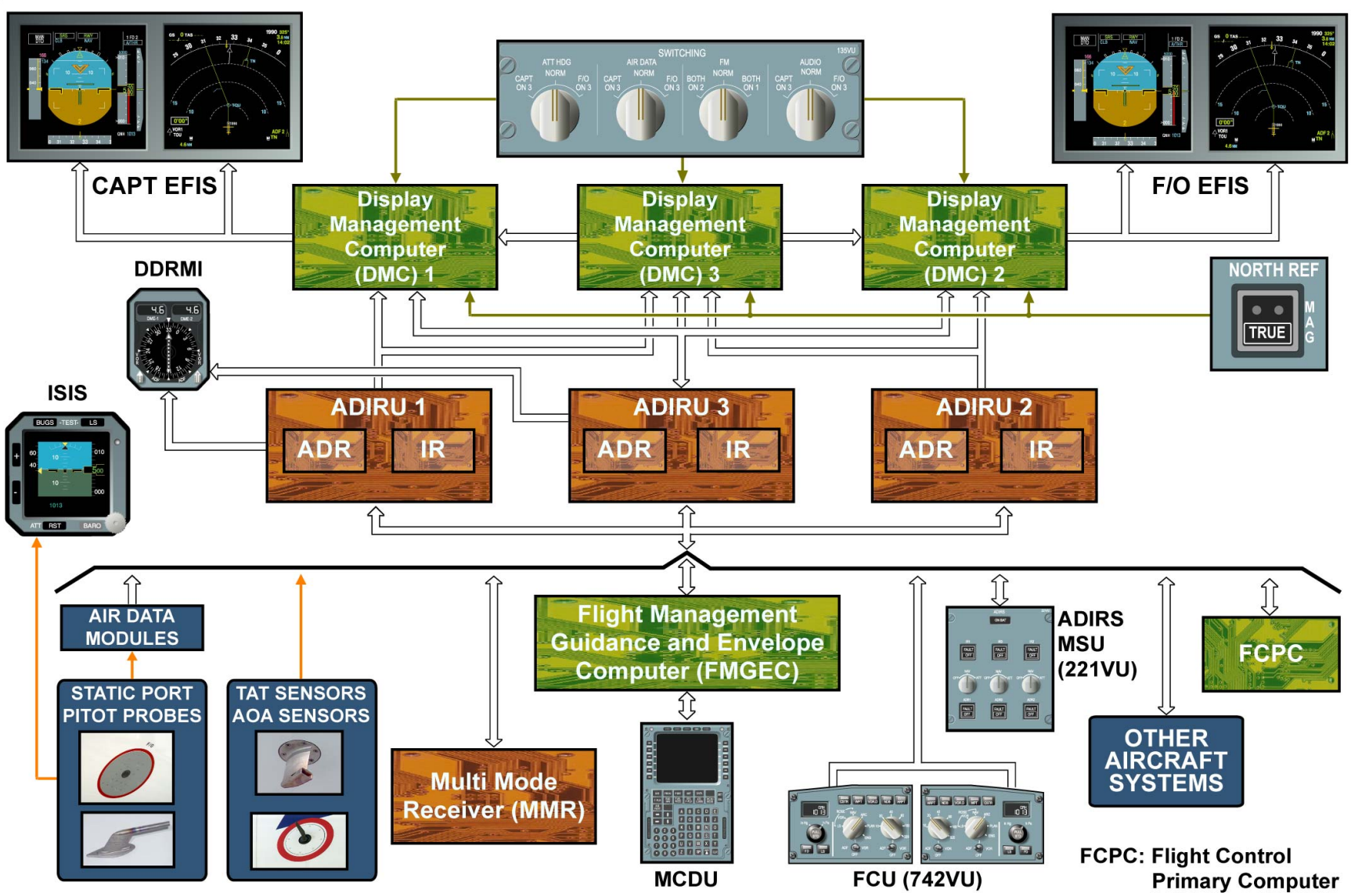

ADIRS GENERAL - INPUTS ... INTERFACE

G9409341 - GAUT0T0 - FM34DB000000001

ADIRS & STANDBY INSTRUMENTS GENERAL DESC. (3)

ISIS GENERAL

The ISIS replaces three conventional standby instruments:
- the standby altimeter,
- the standby horizon indicator,
- the standby airspeed indicator.

PRESENTATION

ISIS is composed of:
- a pressure module with its associated pressure sensors,
- an inertial module with its associated gyroscopes and accelerometers,
- a computation module for operational parameters calculation (altitude, airspeed, attitude) and graphics generation,
- a display module (color liquid crystal display).

DISPLAY

ISIS can display:
- airspeed and Mach number,
- pitch and roll angles,
- lateral acceleration,
- altitude,
- ILS information,
- reference barometric pressure in Hpa.

Optionally, ISIS can also display:
- metric altitude,
- barometric correction in IN.HG,
- magnetic heading.

MAINTENANCE/TEST FACILITIES

ISIS is fitted with a BITE. Specific maintenance and test menus are directly accessible by using the keys on the front face of the instrument. ISIS is connected to the Central Maintenance Computer (CMC) for BITE status interrogation.

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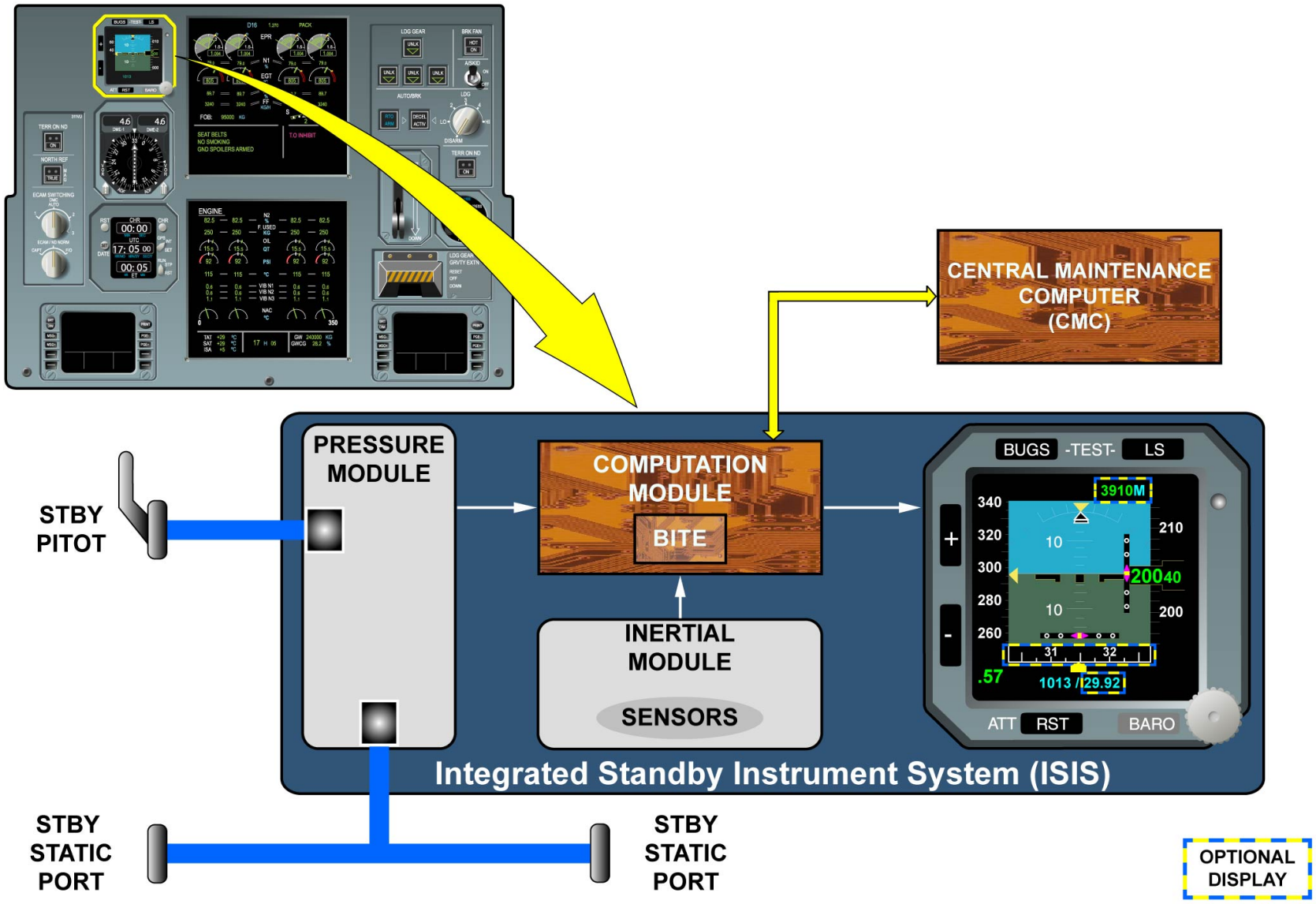

ISIS GENERAL - PRESENTATION ... MAINTENANCE/TEST FACILITIES

G9409341 - GAUT0T0 - FM34DB000000001

RADIO NAVIGATION TUNING DESCRIPTION (3)

GENERAL

The aircraft is fitted with the following radio navigation aids:
- 2 VOR receivers,
- 2 DME receivers,
- 2 ILS receivers,
- 2 ADF receivers (1 or 2 ADF are optional on A340-500/600).

AUTOMATIC TUNING

In normal operation, each Flight Management Guidance and Envelope Computer (FMGEC) automatically tunes its own side receivers via its associated Radio Management Panel (RMP). This is the automatic tuning mode presented in the schematic below.

MANUAL TUNING

In manual tuning mode, the crew uses the RADIO NAV page on the CAPT or F/O MCDU. The manual settings are sent to the corresponding receivers via the FMGECs and the RMPs. When MCDUs 1 and 2 are ON, it is not possible to use MCDU 3 for manual tuning.

MCDU SWITCHING

If one MCDU has failed and has been set to OFF, the third MCDU will take over. If the CAPT and F/O MCDUs are set to OFF, MCDU 3 operates as the CAPT MCDU.

FM SWITCHING

In case of failure of a single FMGEC, the switching panel can direct the control of all the radio navigation receivers to the remaining FMGEC. If one FMGEC fails, manually switching to the remaining FMGEC must be performed through the Flight Management (FM) rotary switch. The valid FMGEC controls its own side receivers, via its own side RMP and the opposite receivers directly.

BACKUP TUNING

If both FMGECs have failed, the receivers can be manually tuned via the RMPs. This is the backup tuning mode. The CAPT and F/O use their RMPs to control their own side receivers. The ILS course and frequency are the only radio navigation data exchanged (ILS 1 and ILS 2 must be identical).

NOTE: Note: the third RMP does not operate in radio navigation backup mode.

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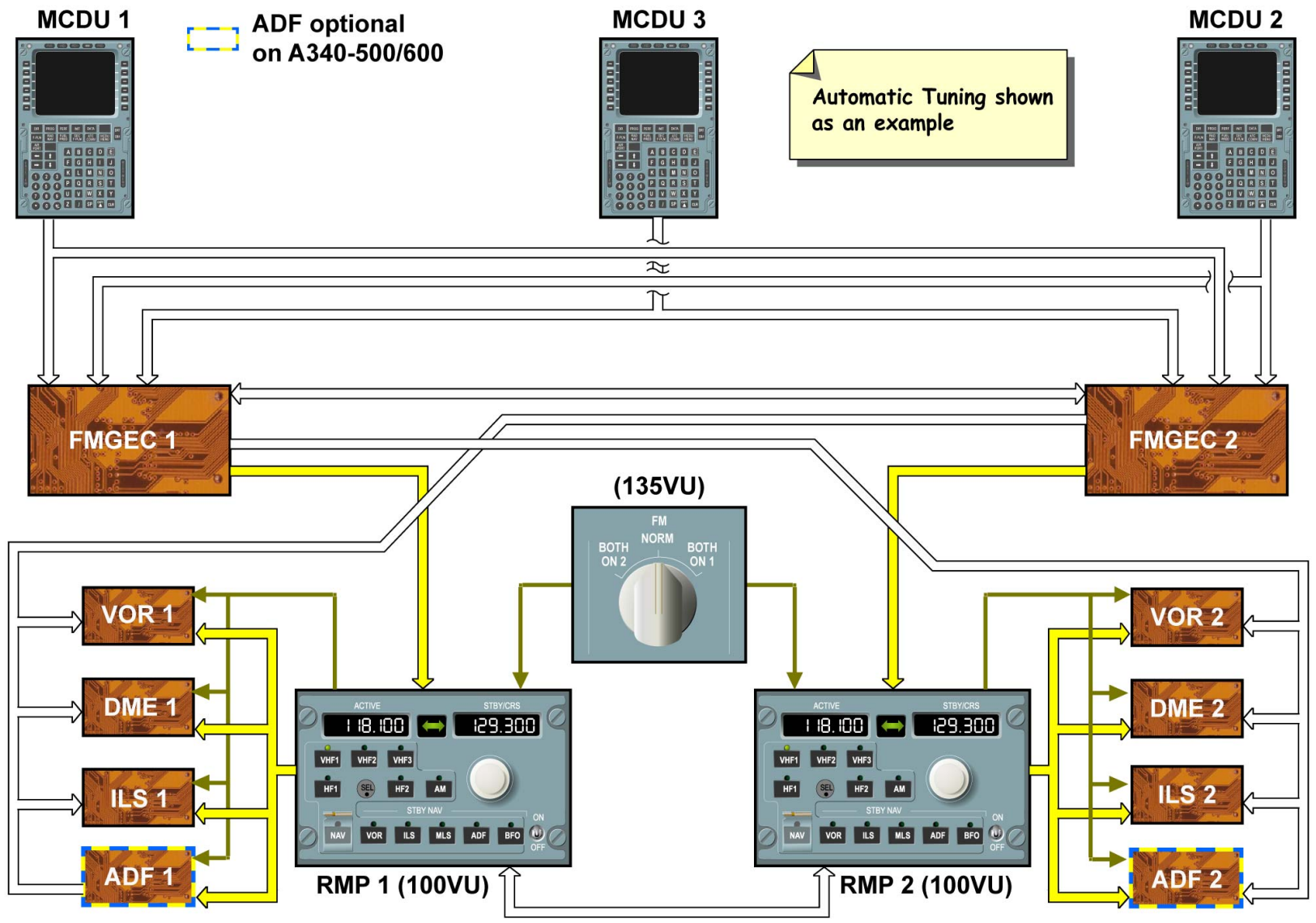

GENERAL ... BACKUP TUNING

G9409341 - GAUT0T0 - FM34DC000000001

ADIRS D/O (3)

ADIRU PRINCIPLE

The Air Data/Inertial Reference Unit (ADIRU) comprises an Air Data Reference (ADR) and an Inertial Reference (IR) both included in a single unit.

SENSOR CONNECTION

The probes are connected to the ADR of the ADIRU.

STATIC PORTS

CAPT and F/O static ports directly provide static pressure to 4 Air Data Modules (ADMs) which convert this pressure into digital format. ADR1 and ADR2 compute the average static pressure value from the left and right ADMs. Standby static ports provide an average pressure directly to the Integrated Standby Instrument System (ISIS) indicator and to a single ADM connected to ADR3.

PITOT PROBES

The three pitot probes directly provide the total pressure to three ADMs. The standby pitot probe also supplies the standby airspeed indicator function of the ISIS indicator.

ANGLE OF ATTACK SENSOR

Each Angle Of Attack (AOA) sensor provides a primary and a backup signal to each ADIRU. In case of failure, the selection is automatically made by the ADIRU. The AOA sensor is equipped with a self-test device which is activated from the MCDU through the ADIRU. The AOA sensors are also called Alpha probes.

TOTAL AIR TEMPERATURE SENSORS

Each Total Air Temperature (TAT) sensor has two independent sensing elements. For the CAPT TAT sensor, sensing elements 1 and 2 are respectively connected to ADR1 and ADR3. For the F/O TAT sensor, only one sensing element is connected to ADR2.

NOTE: Optionally, a specific TAT sensor installed with a tube receives compressed air picked up on the bleed air muscle pressure line manifold. This compressed air induces a suction effect and creates airflow inside the sensor. This type of TAT sensor is used to compensate the solar heating effect on the ground.

WATER DRAIN AND HEATING

The probes are installed in such a way that their pressure lines do not require a water drain except for the stand-by static line. The probe and sensor heating is achieved through the probe heating system.

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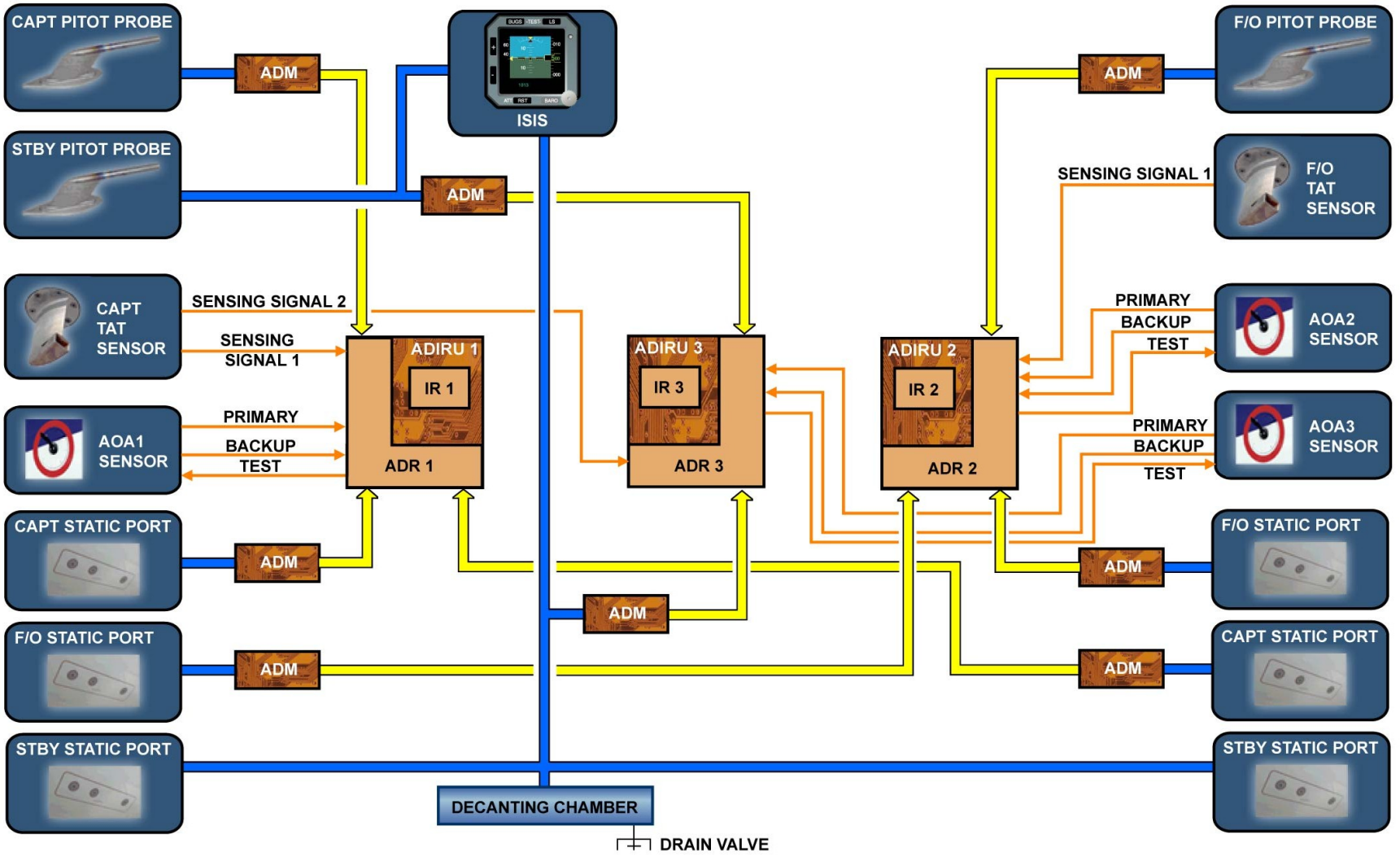

ADIRU PRINCIPLE & SENSOR CONNECTION

ADIRS D/O (3)

AIR DATA MODULE

The static and pitot probes are connected with the ADIRU through the ADMs.

ADM INPUTS

The 8 ADMs are identical and the ADIRU provides 13.5V DC to supply each associated ADM. The ADM inputs have one pressure input and several discrete inputs. The discrete inputs determine the ADM location and the type of pressure data (pitot or static) to provide to the ADR.

ADM FUNCTIONAL DESCRIPTION

A microcomputer processes an ARINC signal according to the discrete inputs and to the digitized pressure.

ADM OUTPUT

The ADM output is an ARINC bus, which provides digital pressure information, type of pressure, ADM identification and BITE status to the ADIRU.

ADR COMPUTATION

The ADR processes sensor and ADM inputs in order to provide air data to users.

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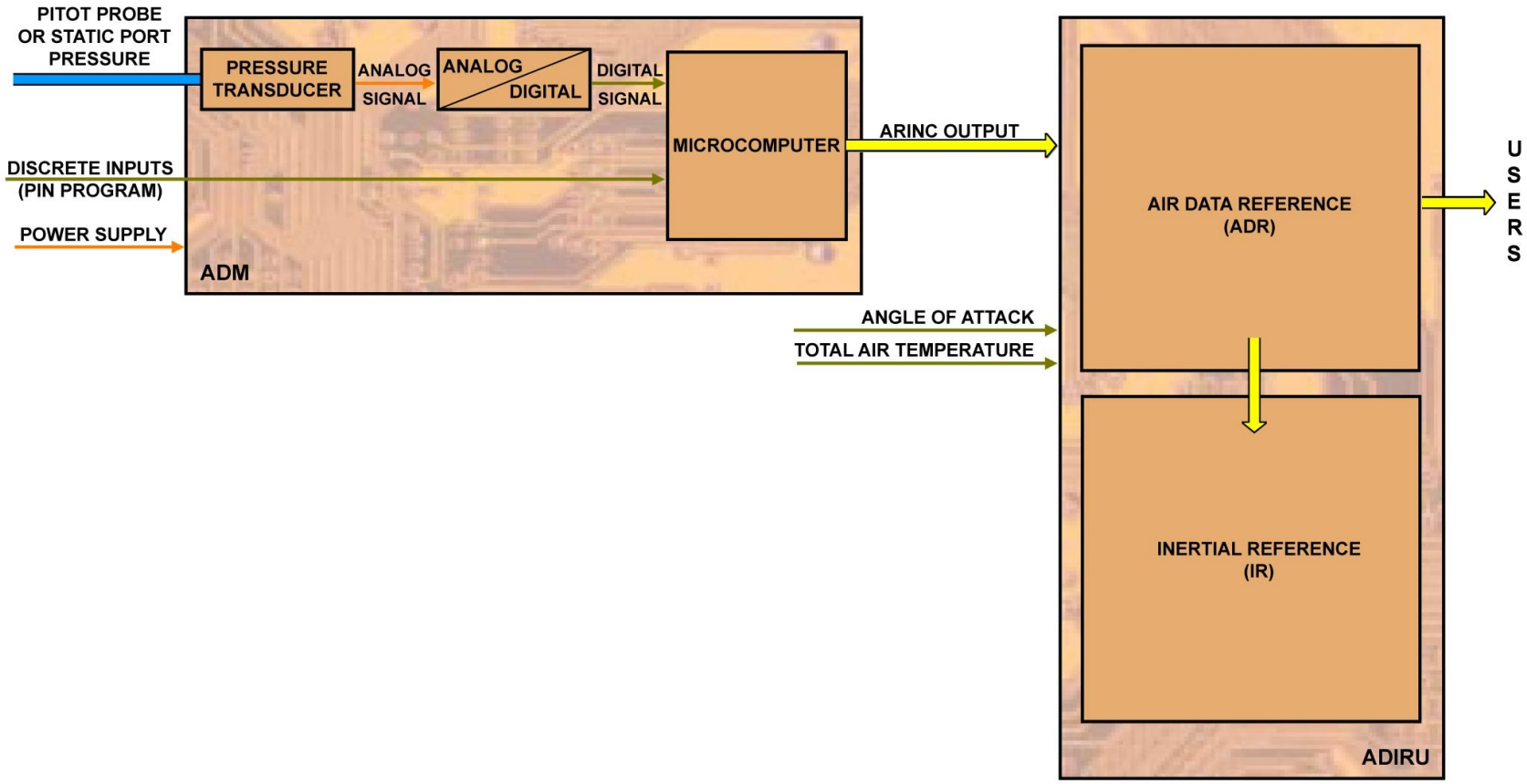


AIR DATA MODULE & ADR COMPUTATION

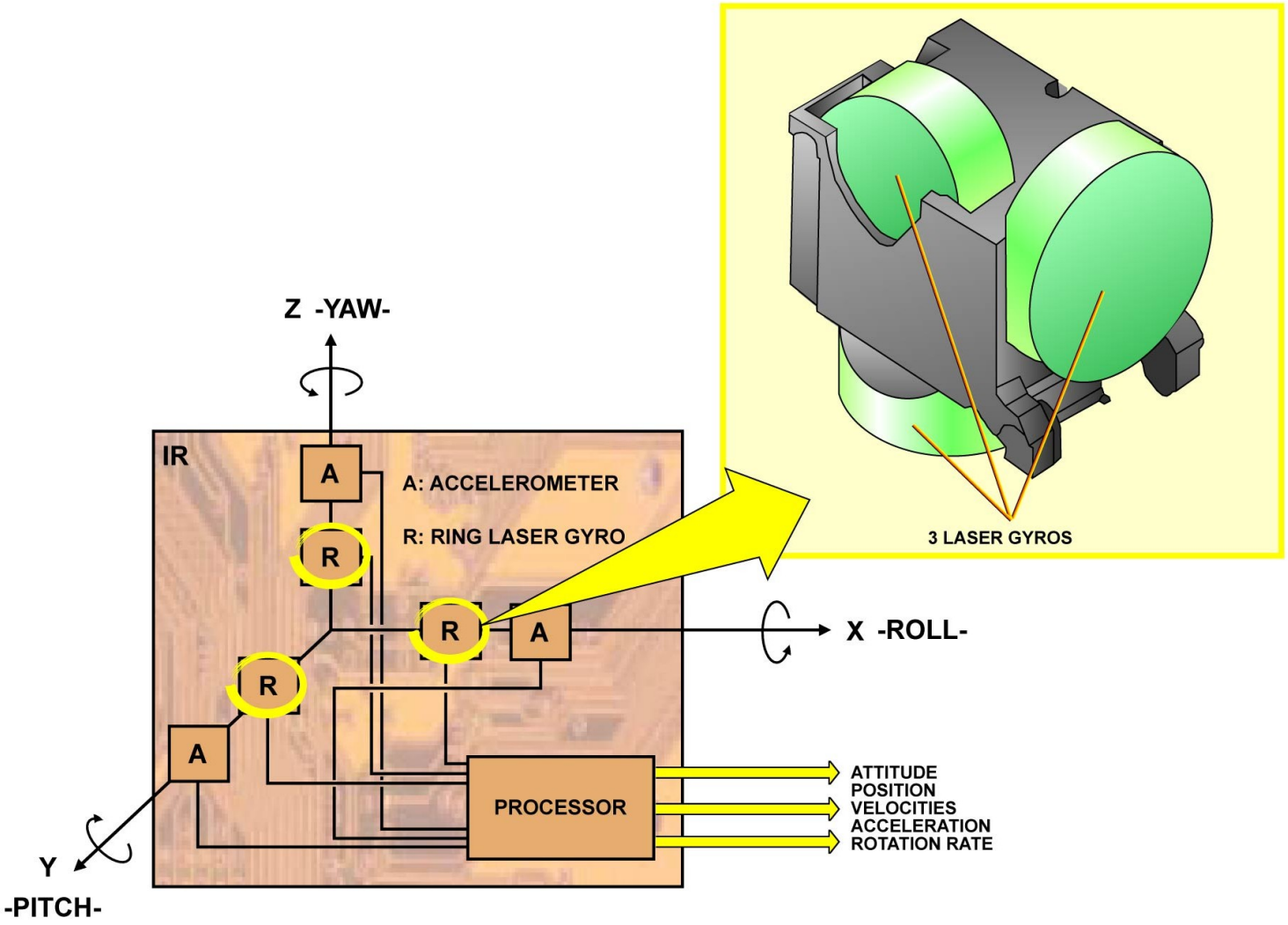
G9409341 - GAUT0T0 - FM34D1000000002

ADIRS D/O (3)

IR COMPUTATION

Three accelerometers, one for each axis, provide linear accelerations. Three ring laser gyros, provided with two laser beams, circulating into a ring, provide inertial rotation rate for each axis. Each ADIRU provides IR data to users by combining the computation of the signals provided by the laser gyros and the accelerometers outputs.

G9409341 - GAUT0T0 - FM34D1000000002



IR COMPUTATION

G9409341 - GAUT0T0 - FM34D1000000002

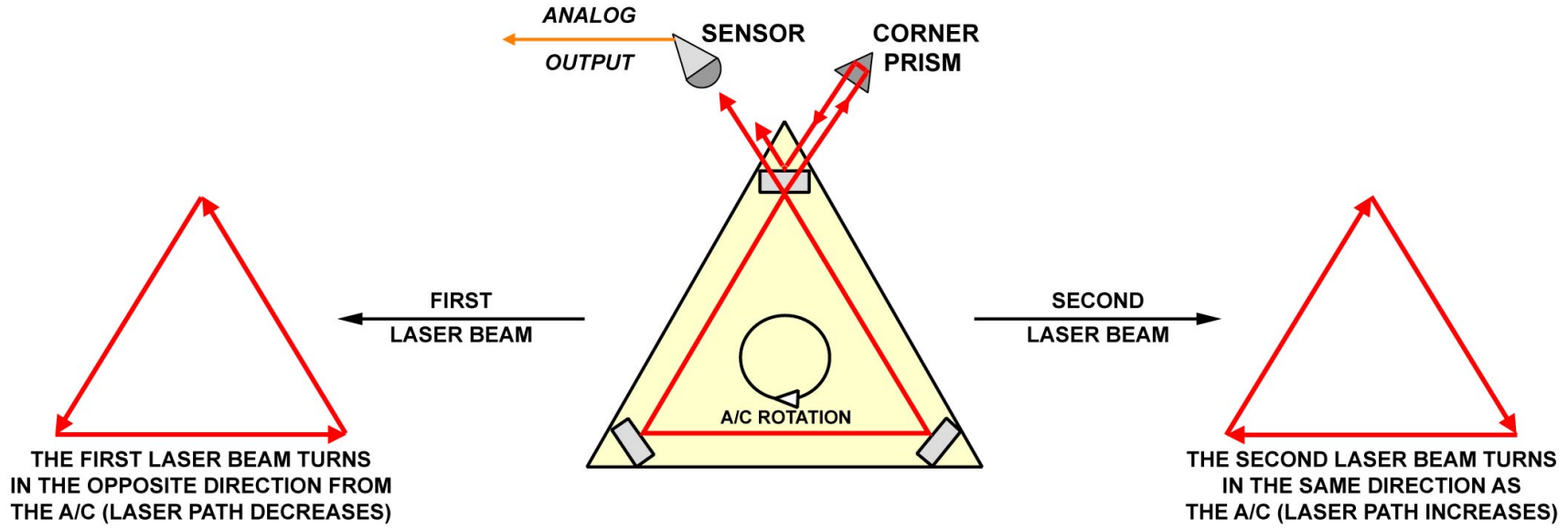
ADIRS D/O (3)

IR COMPUTATION (continued)

RING LASER GYRO

The three ring laser gyros, one for each rotation axis, provide inertial rotation data and are composed of two opposite laser beams in a ring. At rest, the two beams arrive at the sensor with the same frequency. An A/C rotation creates a difference of frequencies between the two beams. The frequency difference is measured by optical means providing a digital output which, after computation, will provide rotation information.

G9409341 - GAUT0T0 - FM34D1000000002



IR COMPUTATION - RING LASER GYRO

ADIRS SWITCHING D/O (3)

PRINCIPLE

The Air Data/Inertial Reference System (ADIRS) is composed of three Air Data/Inertial Reference Units (ADIRUs). Various instruments and systems receive data from the ADIRS such as the PFD, the ND, the ECAM SD for inertial and air data display, via the Display Management Computers (DMCs), or directly for the Digital Distance and Radio Magnetic Indicator (DDRMI).
The ADIRS provides barometric altitude to the mode S of the ATC transponder.
The ADIRS provides data to the Flight Management Guidance and Envelope Computer (FMGEC) for aircraft position computation and for the computation of various characteristic speeds.
The ADIRS provides data to the Weather Radar (WXR) system for antenna attitude stabilization.
Basically, ADIRU 1 is associated with system 1 and the DDRMI, ADIRU 2 with system 2, and ADIRU 3 is in standby.
If an Air Data Reference (ADR) or an Inertial Reference (IR) fails, the AIR DATA or ATTitude HeaDingG selector enables the crew to use ADR 3 or IR 3. The manual switching is mainly performed to recover displays. The computers select their inputs according to the switching for consistency of computation and display.

NOTE: Each FMGEC receives data from the 3 ADIRUs. The switching only concerns characteristic speeds.
The ADIRU data sent to the ECAM SD are Static Air Temperature (SAT), Total Air Temperature (TAT) and International Standard Atmosphere (ISA).

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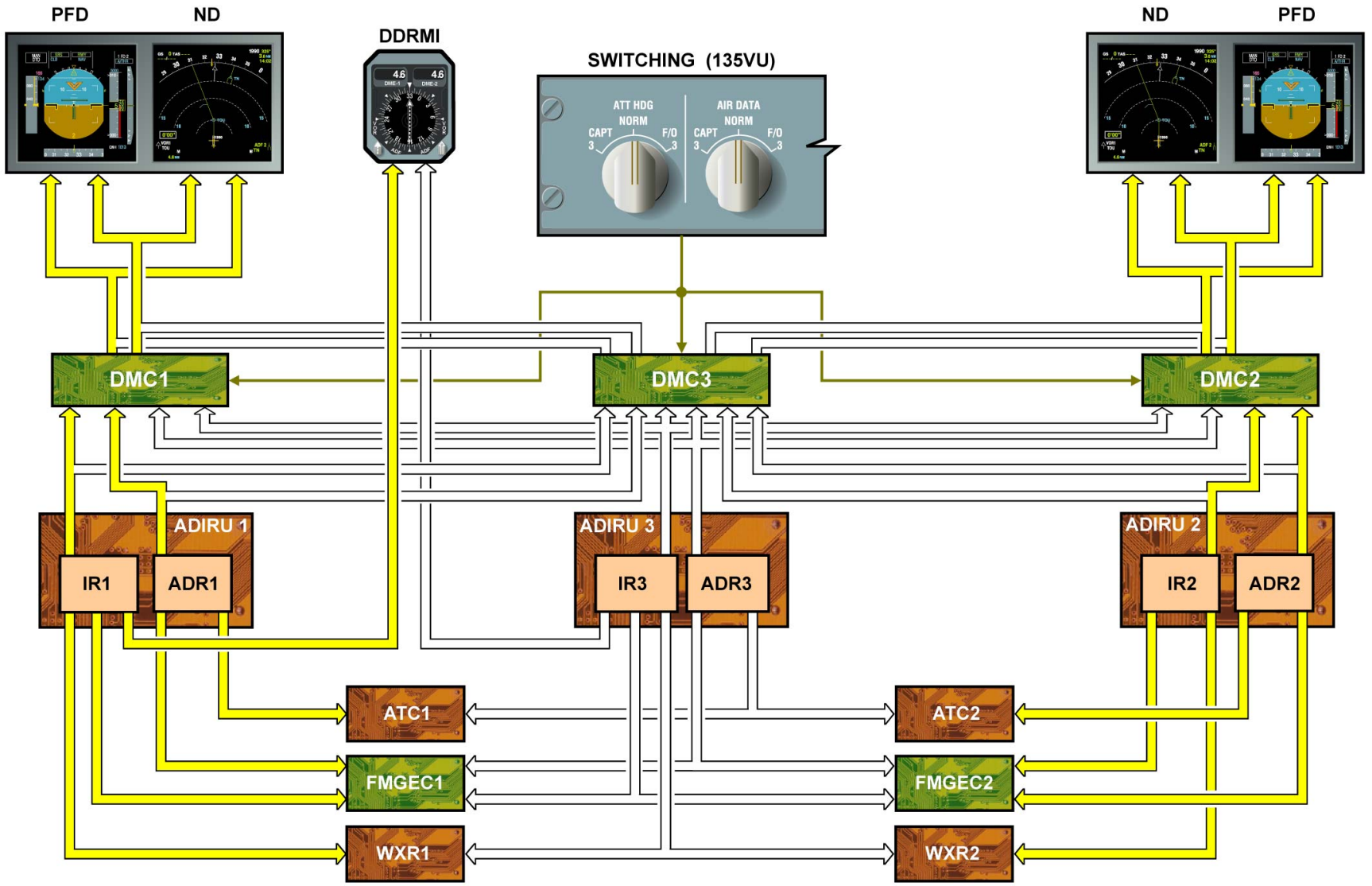


PRINCIPLE

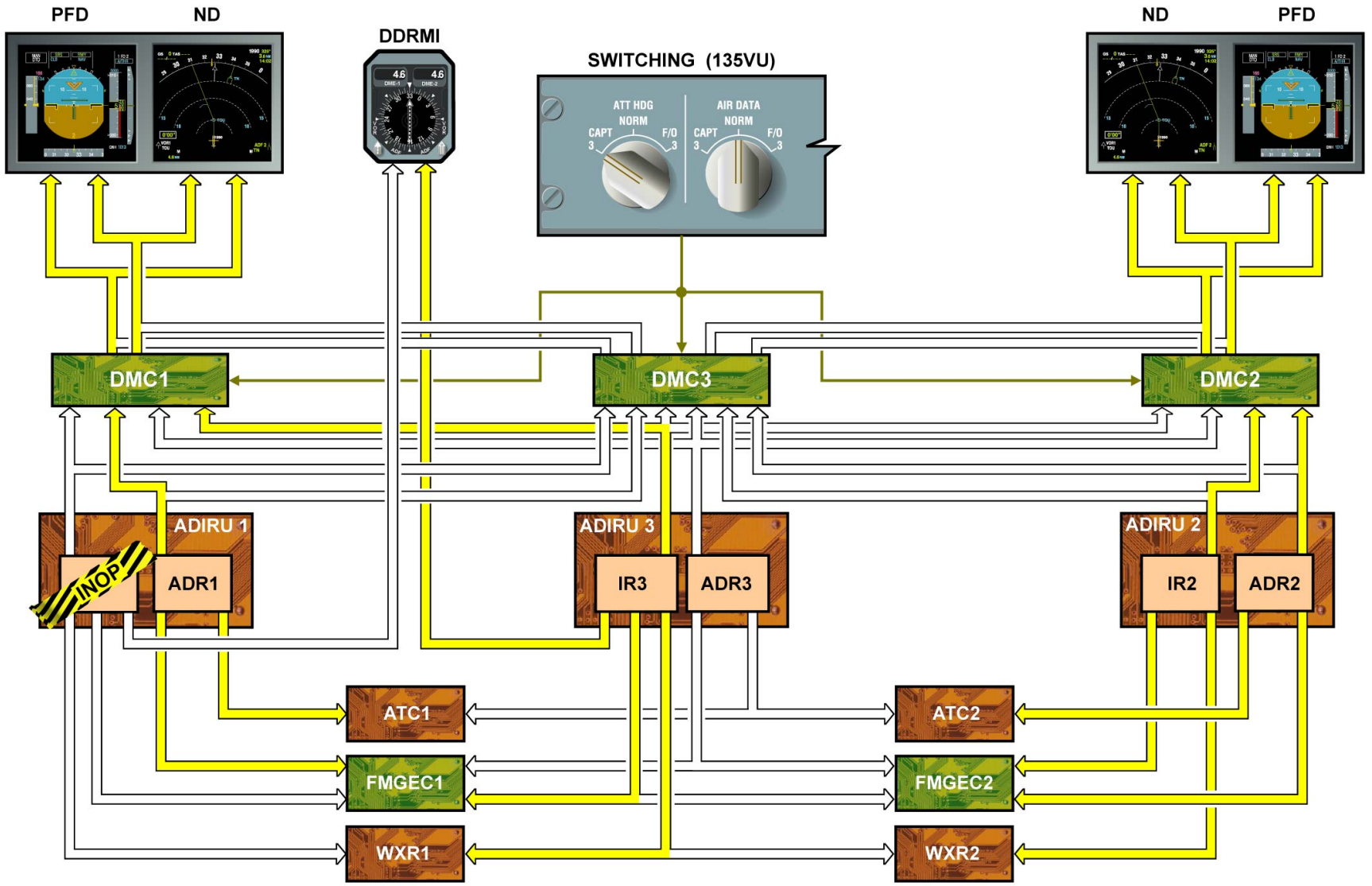
G9409341 - GAUT0T0 - FM34D2F34AE0302

ADIRS SWITCHING D/O (3)

SWITCHING

Here is an example of ADIRS switching IR 1 failed in order to see the effect on the schematic.

G9409341 - GAUT0T0 - FM34D2F34AE0302



SWITCHING

G9409341 - GAUT0T0 - FM34D2F34AE0302

STANDBY INSTRUMENTS D/O (3)

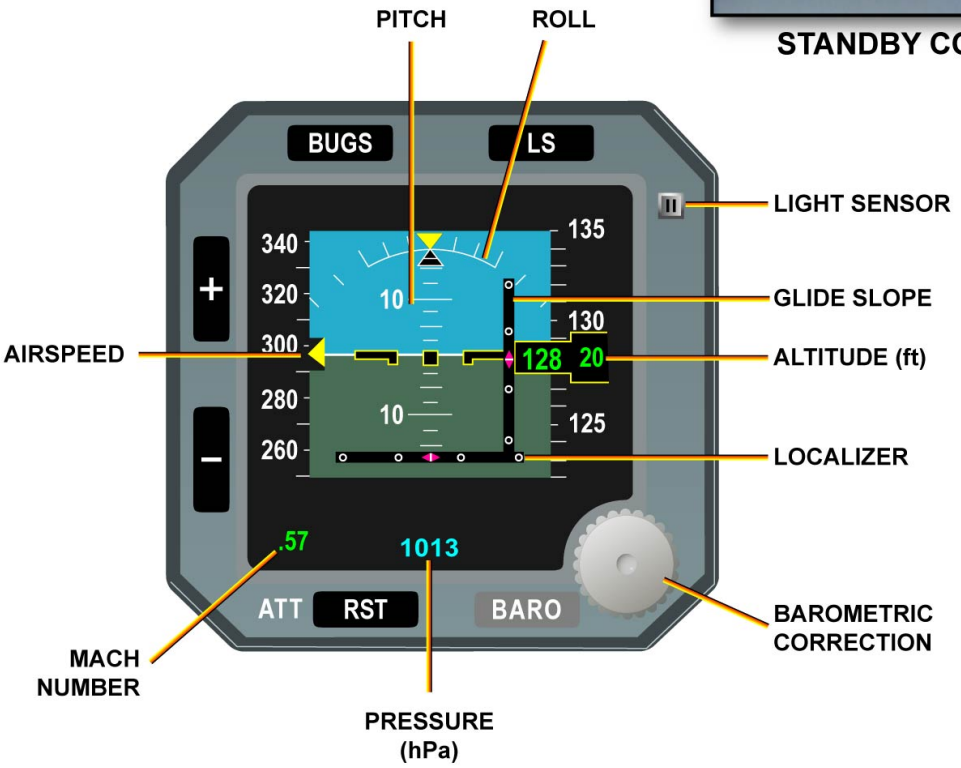
GENERAL

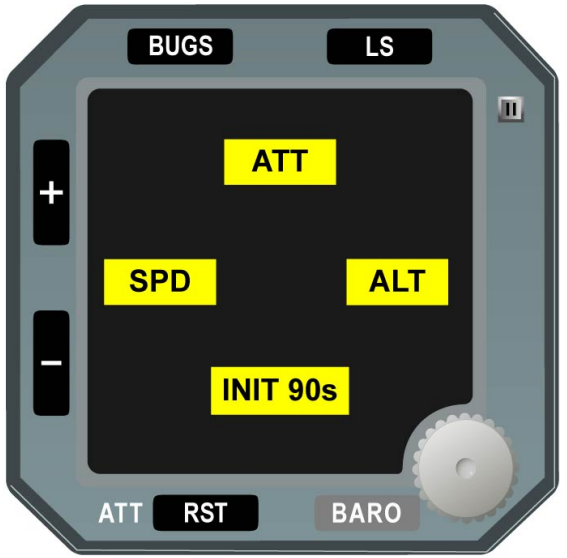
The aircraft is fitted with a standby compass that displays the magnetic heading, and one Integrated Standby Instrument System (ISIS), which is a combined standby altimeter, horizon indicator and airspeed indicator.
The ISIS displays the following information:
- airspeed,
- mach number,
- pitch and roll angles,
- lateral acceleration,
- altitude in feet (ft),
- Glide Slope (G/S) and LOCalizer deviations,
- BAROmetric reference in hectopascals (hPa).

A light sensor on the ISIS front face automatically controls the display brightness. As soon as the ISIS is energized, it shows the initialization display for 90 s. This display has four yellow boxes indicating ATTitude, SPeeD, ALTitude and INIT 90s.

G9409341 - GAUT0T0 - FM34D3000000002

STANDBY COMPASS





ISIS
(INITIALISATION DISPLAY)

GENERAL

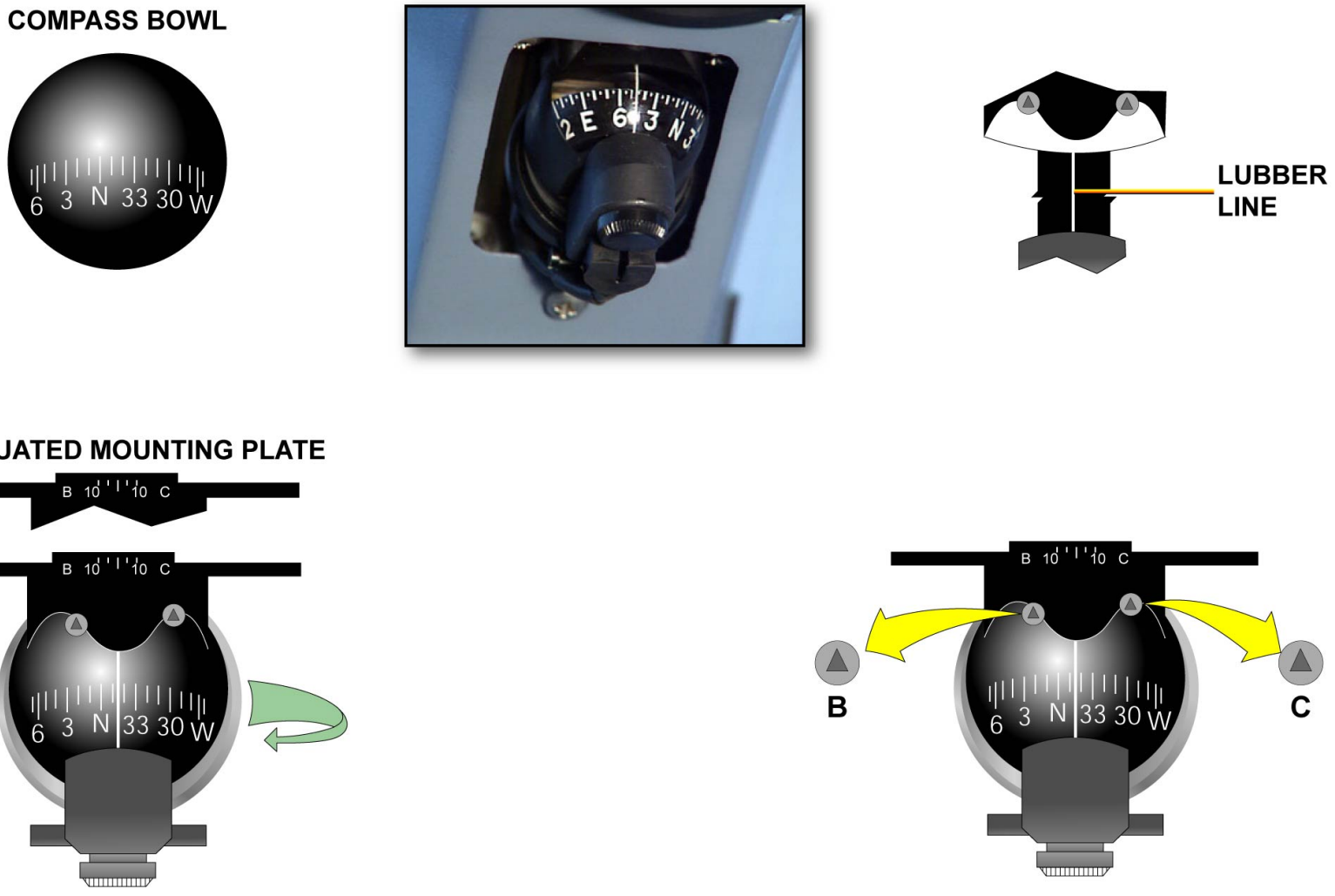
G9409341 - GAUT0T0 - FM34D3000000002

STANDBY INSTRUMENTS D/O (3)

STANDBY COMPASS

The standby compass provides the crew with magnetic heading. It consists of a magnetic element rotating freely inside a compass bowl. The compass bowl is immersed in a damping liquid. The magnetic element is linked to a compass card, which moves behind a lubber line and gives the magnetic heading. Rotating the standby compass on its mounting screws can provide a correction of deviation. The upper mounting plate is provided with graduations, which indicate the number of degrees of deviation. A non-magnetic lamp assembly provides illumination of the reading dial. Compensation is achieved by inserting a special key in two holes, marked B and C, located below the graduated mounting plate. In the cockpit, on the center vertical member, a label is installed and provides information on the last calibration of the standby compass.

G9409341 - GAUT0T0 - FM34D3000000002



STANDBY COMPASS

STANDBY INSTRUMENTS D/O (3)

ISIS

DESCRIPTION

The back of ISIS is equipped with two pressure connectors:
- one is connected to the standby pitot probe for total pressure acquisition,
- the other one is connected to the combined standby static probes for static pressure acquisition.

The ISIS indicator contains the following subassemblies:
- one pressure module,
- one inertial module,
- one computation module,
- one display module and,
- one interface module.

The pressure module is connected to the total and static pressure connectors. Each pressure line is connected to a pressure sensor in the pressure module. The inertial module is composed of three gyrometers (gyrolaser) measuring angular speeds and two specific linear accelerometers (pitch + roll). The computation module includes a Central Processing Unit (CPU), which calculate the operational parameters (attitude, altitude and airspeed), and a graphic card, which receives the data from the CPU and sent it to the display module. The display module is fitted on the front face of ISIS. It is of the Liquid Crystal Display (LCD) type. The front face is also fitted with several knobs for operation purposes. The interface module is composed of:
- a filtering board linked to an electrical connector at the back of ISIS,
- the 28V DC power supply unit,
- the interface board which links the pressure, inertial, computation and display modules.

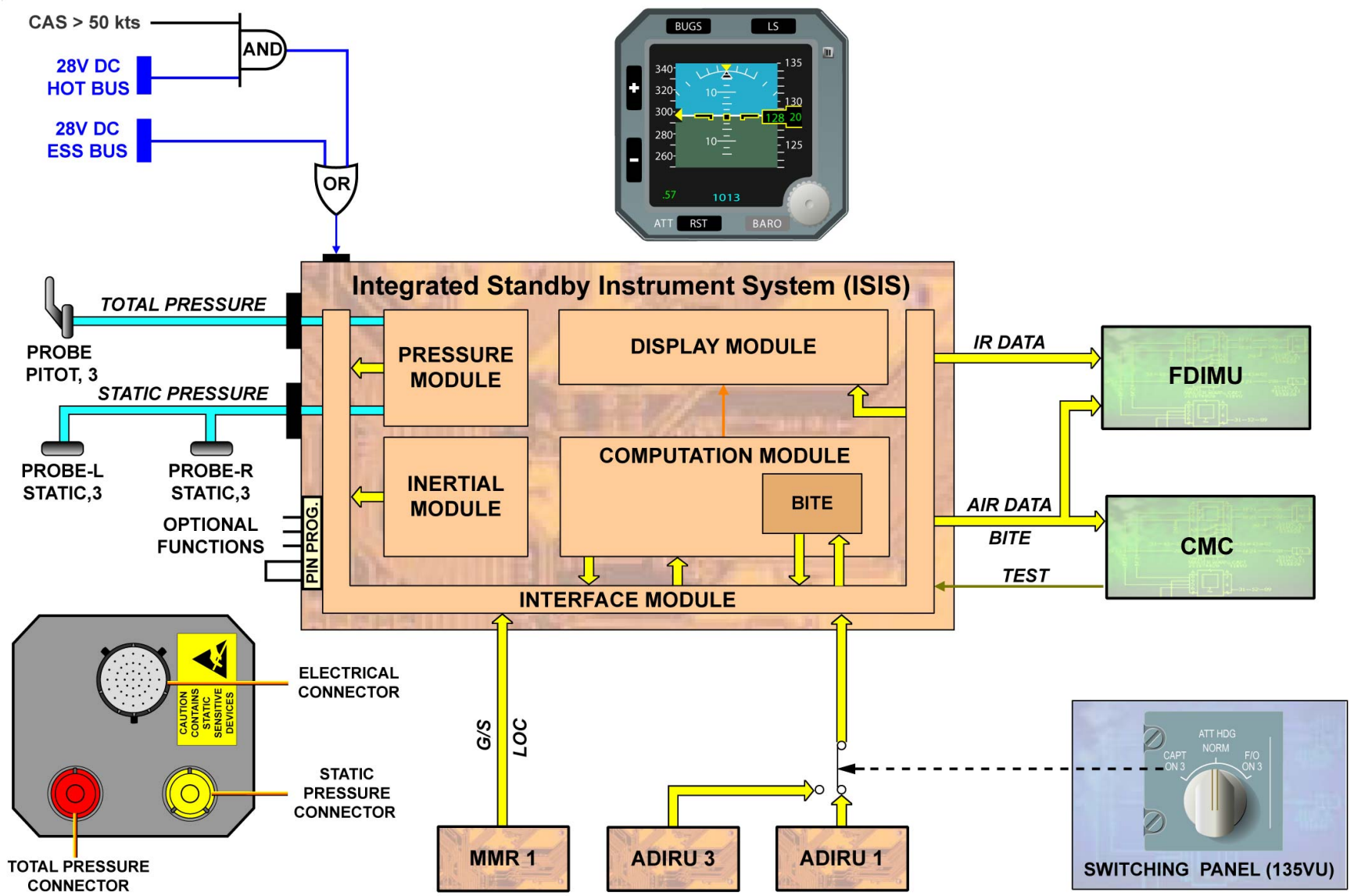
POWER SUPPLY

ISIS is supplied with 28V DC from the ESSential BUS bar. In case of loss of this bus bar, the HOT BUS bar automatically takes over, provided the Computed Air Speed (CAS) is greater than 50 kts. In case of a power supply cut-off less than 50 ms, there is no effect on the display.

OPERATION

When ISIS is energized, a delay of 90 seconds is necessary for initialization. ISIS computes and displays own air and inertial parameters. When the airspeed data is not valid, the CAS information is provided as a back-up by Air Data/Inertial Reference Unit (ADIRU) 1 or ADIRU 3 regarding the ATT/HDG selector switch position. The ADIRU also provides a Ground Speed (GS) information for flight/ground condition, as a back-up. A BAROmetric selector knob enables the display and adjustment of the standard barometric pressure in hPa. When the Landing System P/BSW, located on the upper right part of the indicator, is pushed, the G/S and LOC scales come into view. The BUGS P/BSW allows to display the BUGS page. This page is used to program characteristic speeds and altitudes displayed on the related speed and altitude scales. The (-) P/B is used to get access to the next bug and the (+) P/B to return to the previous bug. Air and inertial parameters are processed by the computation module using data from the pressure and inertial modules. The pressure module sends the total and static pressure data while the inertial module sends accelerations and angular rates data. Once computed, the parameters are sent to the display module for indication to the crew. The LS data is sent by the Multi-Mode Receiver (MMR) 1. Air Data/Inertial Reference System (ADIRS) parameters computed by ISIS are sent to the Flight Data Interface and Management Unit (FDIMU). The ISIS can operate from 0 to 600 kts without deterioration of airspeed data. It can operate from -2.500 to 55.000 ft and up to 40.000 ft/min without deterioration of altimeter data. For the horizon data, the ISIS can operate from -180 to +180 deg without deterioration.

G9409341 - GAUT0T0 - FM34D3000000002



ISIS - DESCRIPTION ... OPERATION

G9409341 - GAUT0T0 - FM34D3000000002

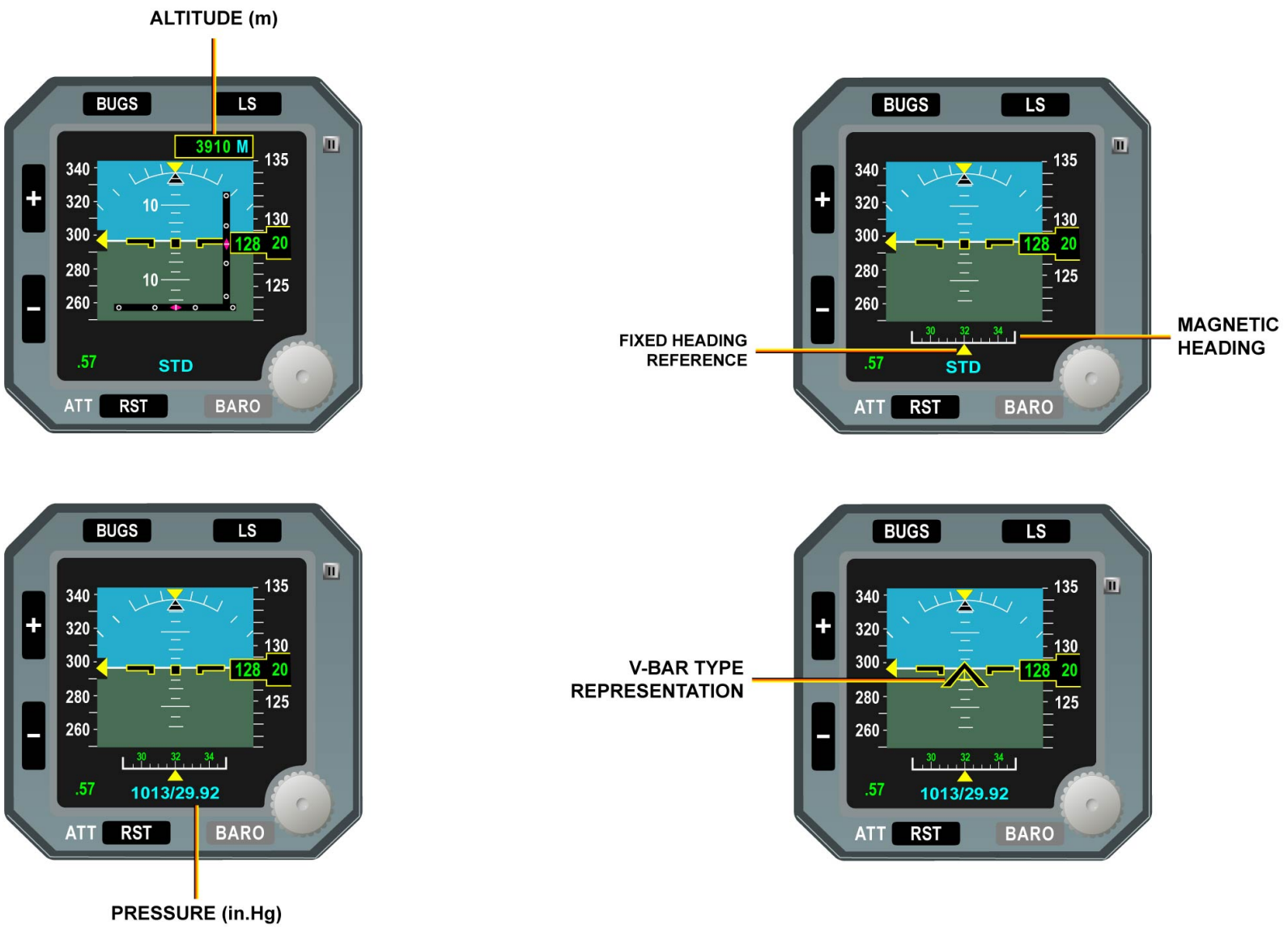
STANDBY INSTRUMENTS D/O (3)

ISIS (continued)

OPTIONAL DISPLAYS

Optional functions can be activated through pin programming:
- the metric altitude, which can be displayed in the upper right section of the display in addition to the altitude in feet. In case of negative altitude, the NEG indication is displayed in white just before the metric altitude value.
- the magnetic heading, which is provided by the Inertial Reference (IR) 1 or IR 3. In case of detected failure of the selected ADIRU, a red HDG flag is displayed in place of the magnetic heading scale. If the LS function is selected, the LS bars (LOC and G/S) are displayed in place of the magnetic heading indications.
- the barometric correction value in in.Hg, which is displayed in cyan color in the center lower section of the display area, in addition to the barometric correction value in hPa.
- the V-bar type representation of the A/C.

G9409341 - GAUT0T0 - FM34D3000000002



ISIS - OPTIONAL DISPLAYS

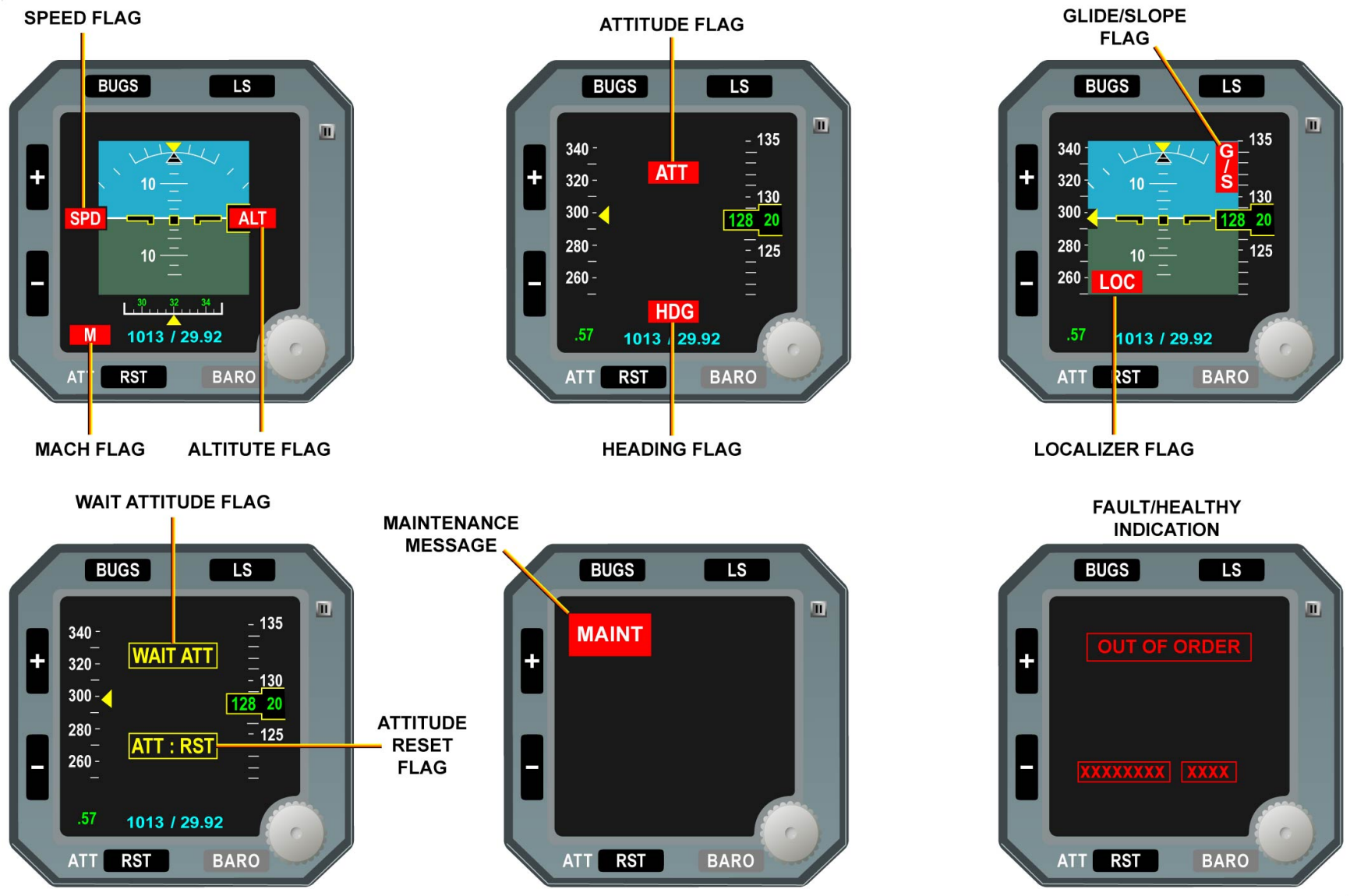
STANDBY INSTRUMENTS D/O (3)

ISIS (continued)

ABNORMAL OPERATION

When the airspeed data is not valid, a red SPD flag is displayed in place of the airspeed scale. When the Mach number (always computed) is not valid, a red M flag is displayed in place of the Mach number value. When the altitude data is not valid, a red ALT flag is displayed in place of the altitude scale. In case of detected failure of the pitch and/or roll angle information, the whole attitude and guidance display is replaced by the ATT red flag. LOC and G/S red flags are displayed independently in case of loss of the LOC and/or GS signals. The " WAIT ATT" message appears when the inertial sensors are out of attitude domain (in case of an excessive angular acceleration for gyros and linear acceleration for accelerometers). The normal operational display is automatically retrieved within 10s. The "ATT : RST" message can appear on ground during ISIS alignment phase, or 10s after WAIT ATT when the attitude function is not automatically reset. The ISIS also performs an excessive test motion during the whole initialization phase. If an A/C motion is detected, the attitude information is flagged and the "ATT: RST" message is displayed at the end of the INIT. A manual reset must be performed during stabilized phase (Roll = 0). The attitude reset allows realignment and recovery of the attitude indication. To reset the attitude (Gyrometers and accelerometers), the ATT RST P/B has to be pressed in for at least 2s. "ATT 10s" appears during the reset. A specific MAINT message is also displayed during power-up if an invalid pin configuration is detected. One discrete output is used for fault/healthy indication. In case of a fatal failure of the ISIS, the red OUT OF ORDER message associated with the related fault code is shown.

G9409341 - GAUT0T0 - FM34D3000000002



ISIS - ABNORMAL OPERATION

G9409341 - GAUT0T0 - FM34D3000000002

STANDBY INSTRUMENTS D/O (3)

ISIS (continued)

MAINTENANCE OPERATION

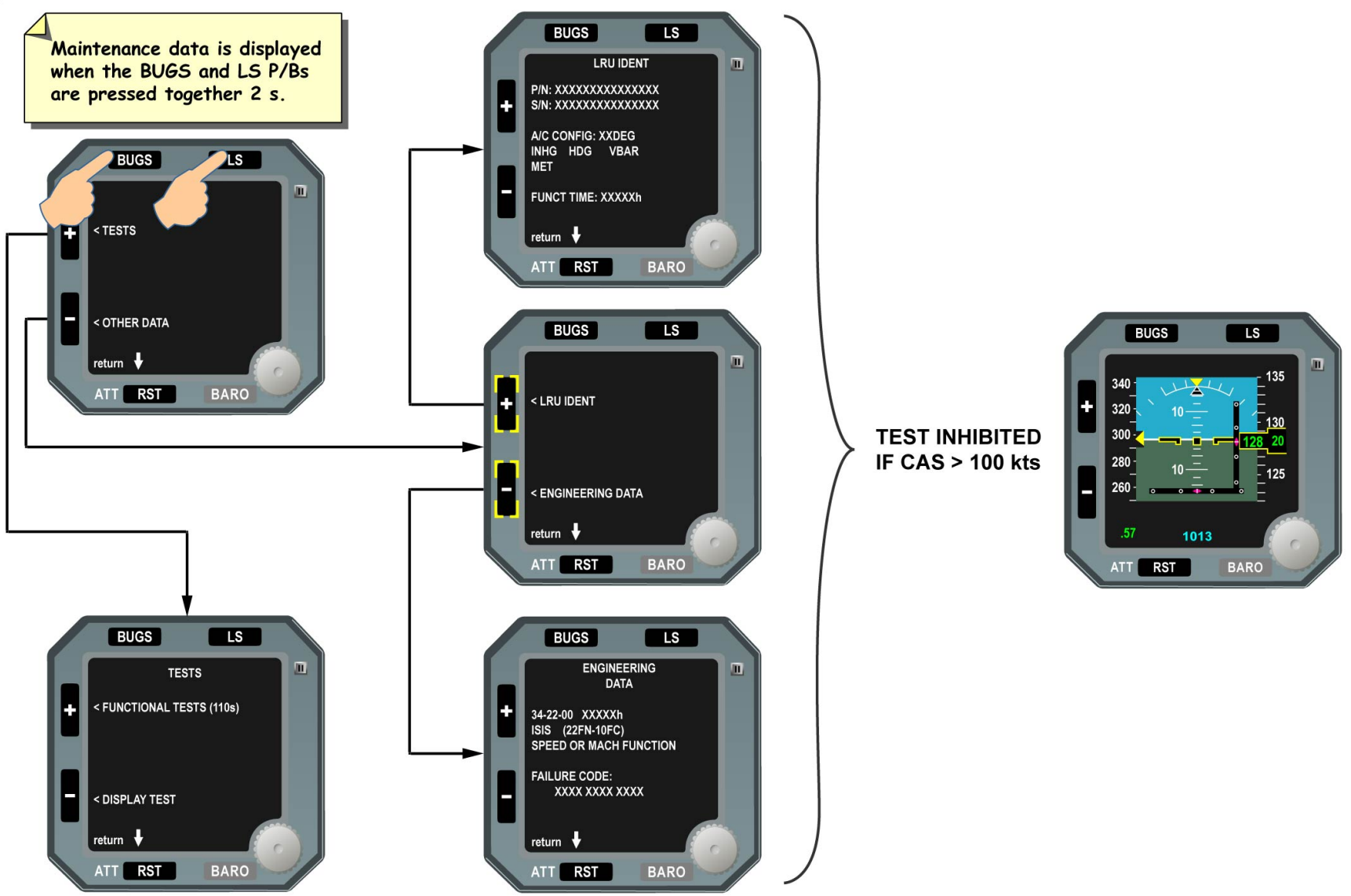
ISIS is a type II equipment and is fitted with a BITE. The ISIS indicator is able to display maintenance data when the BUGS and LS P/Bs are pushed simultaneously at least 2 s. In this case, a menu with two items is shown on screen: TESTS and OTHER DATA. The P/Bs adjacent to these items give access to the related menus. The TESTS menu gives access to the FUNCTIONAL TEST and DISPLAY TEST, which enable the LCD state quality to be checked and the functional test of ISIS to be started. In case of fault detection, a fault message is displayed and ISIS sends the information to the Central Maintenance Computer (CMC). The OTHER DATA menu is made of two items: LRU IDENT and ENGINEERING DATA. When the (+) P/B next to the LRU IDENT item is pushed, the display shows the:
- ISIS Part Number (PN) and the Serial Number (SN),
- A/C configuration (active options),
- functional time counter (operating hours).

When the (-) P/B next to ENGINEERING DATA is pushed, the display shows the:
- ATA reference and time,
- component identification and Functional Item Number (FIN),
- failure code data.

If there is more than one data page, pushing the (+) or (-) P/Bs enables to go to the next or previous data pages. Pushing the RST P/B enables to return to the previous menu page. Pushing the RST P/B several times restores the operational display.

NOTE: The ISIS has an internal flight/ground logic, which manages the BITE function and prevents maintenance mode activation in flight. The test is inhibited when the CAS is greater than 100 kts.

G9409341 - GAUT0T0 - FM34D3000000002



ISIS - MAINTENANCE OPERATION

G9409341 - GAUT0T0 - FM34D3000000002

SATELLITE NAVIGATION D/O (3)

GLOBAL POSITIONING SYSTEM FUNCTION

The GPS function is a stand-alone satellite navigation sensor utilizing the coarse acquisition code of the NAVSTAR GPS satellites. The GPS has twelve channels, each capable of tracking NAVSTAR GPS satellite signals. The GPS primary function is to track the radio frequency signal received from the antenna, determine the signal code phase and carrier phase, compute the A/C position and output the navigation data to the three Air Data Inertial Reference Units (ADIRUs).
The GPS antenna is an L-band active antenna. It is designed to operate at 1575.42 MHz with a RH circular polarization and to provide an omnidirectional radiation pattern.

AIR DATA INERTIAL REFERENCE UNIT

In normal operation, the GPS 1 data is used by ADIRUs 1 and 3 and the GPS 2 data by ADIRU 2. In order to reduce GPS initialization time, ADIRUs 1 and 2 respectively send data to GPS 1 and 2 such as Inertial Reference (IR) position, altitude, date and Universal Time Coordinated (UTC).

FLIGHT MANAGEMENT GUIDANCE AND ENVELOPE COMPUTER

The IR portions of ADIRUs 1 and 2 respectively provide Flight Management Guidance and Envelope Computers (FMGECs) 1 and 2 with pure IR data, hybrid global positioning inertial reference data used by the FMGEC for position-fixing purposes called GPIRS position and pure GPS data which is displayed on the MCDU, in this case operating the ADIRU as a relay.
In case of failure of one GPS the three ADIRUs automatically select the only operative GPS to compute hybrid global positioning inertial reference data (GPIRS position).

ATT/HDG SWITCHING

In case of failure of ADIRU 1, FMGEC 1 uses ADIRU 3 / GPS 1 data and in case of failure of ADIRU 2, FMGEC 2 uses ADIRU 3 / GPS 2 data.
The primary source of ADIRU 3 being GPS 1, it is necessary to select the secondary input port of ADIRU 3 (GPS2) by means of the ATT/HDG selector switch to keep side 1/side 2 segregation (GPS1/ADIRU1/FMGEC1 and GPS2/ADIRU3/FMGEC2 architecture).

MONITORING

The GPSs are monitored by the three ADIRUs using the status word sent by each GPS and the BITE of the IR portion.
In case of GPS failure, the NAVGPS 1(2) FAULT message is displayed in the lower part of the EWD. This message is accompanied by an activation of the MASTER CAUTion lights on the glareshield, and an aural warning that is a Single Chime (SC) (level 2 alert).

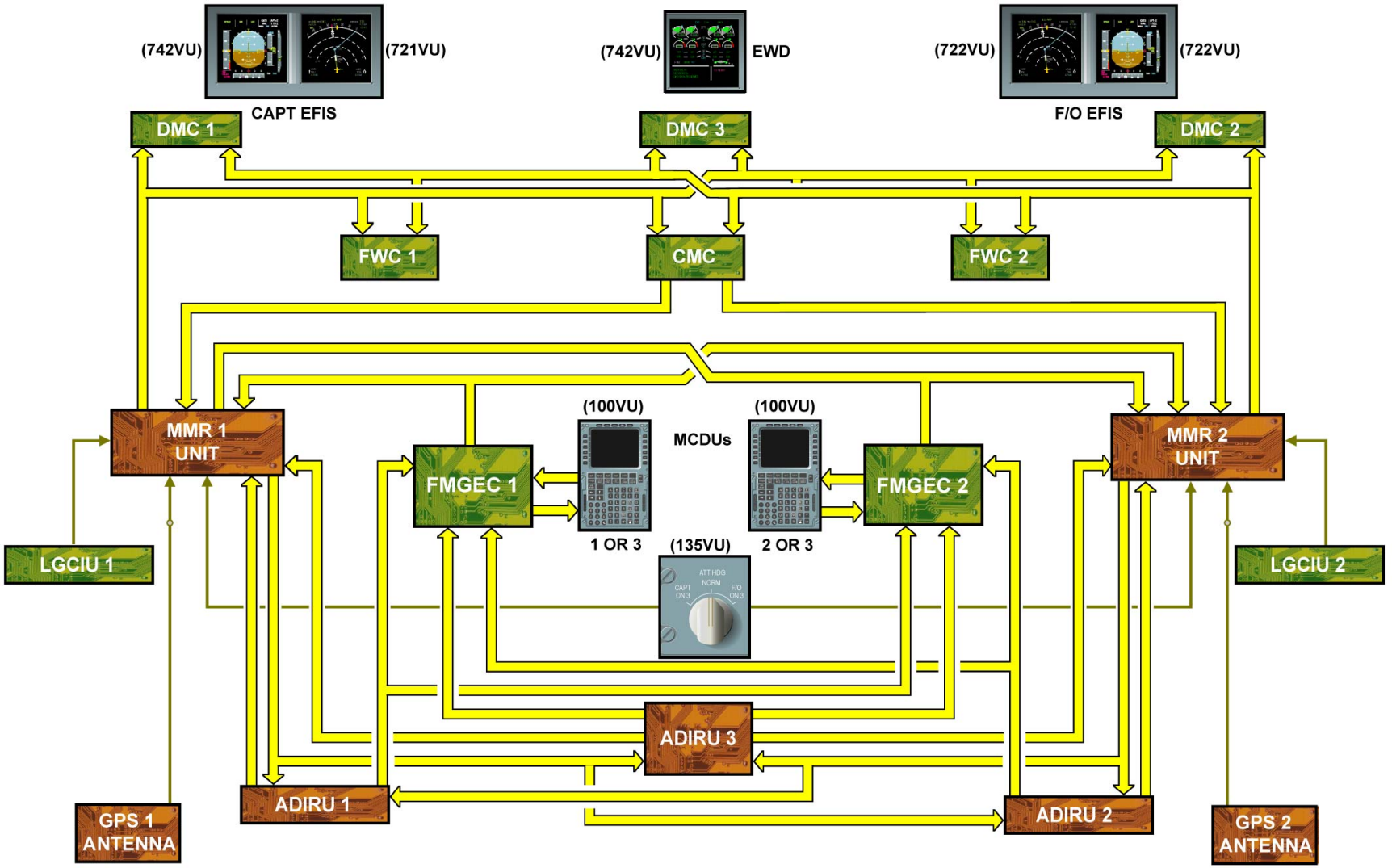
INDICATING

The GPS data is displayed on the GPS monitor page of the MCDU through the FMGEC and operational messages may be displayed on the NDs.
The data displayed on the MCDU is:
- GPS position given by the latitude and longitude,
- true track,
- figure of merit given in meters,
- ground speed,
- GPS altitude,
- mode and number of satellites tracked.

CENTRAL MAINTENANCE COMPUTER

The MCDUs allow the system to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground.

G9409341 - GAUT0T0 - FM34D4F34JB0102



GLOBAL POSITIONING SYSTEM FUNCTION & AIR DATA INERTIAL REFERENCE UNIT

G9409341 - GAUT0T0 - FM34D4F34JB0102

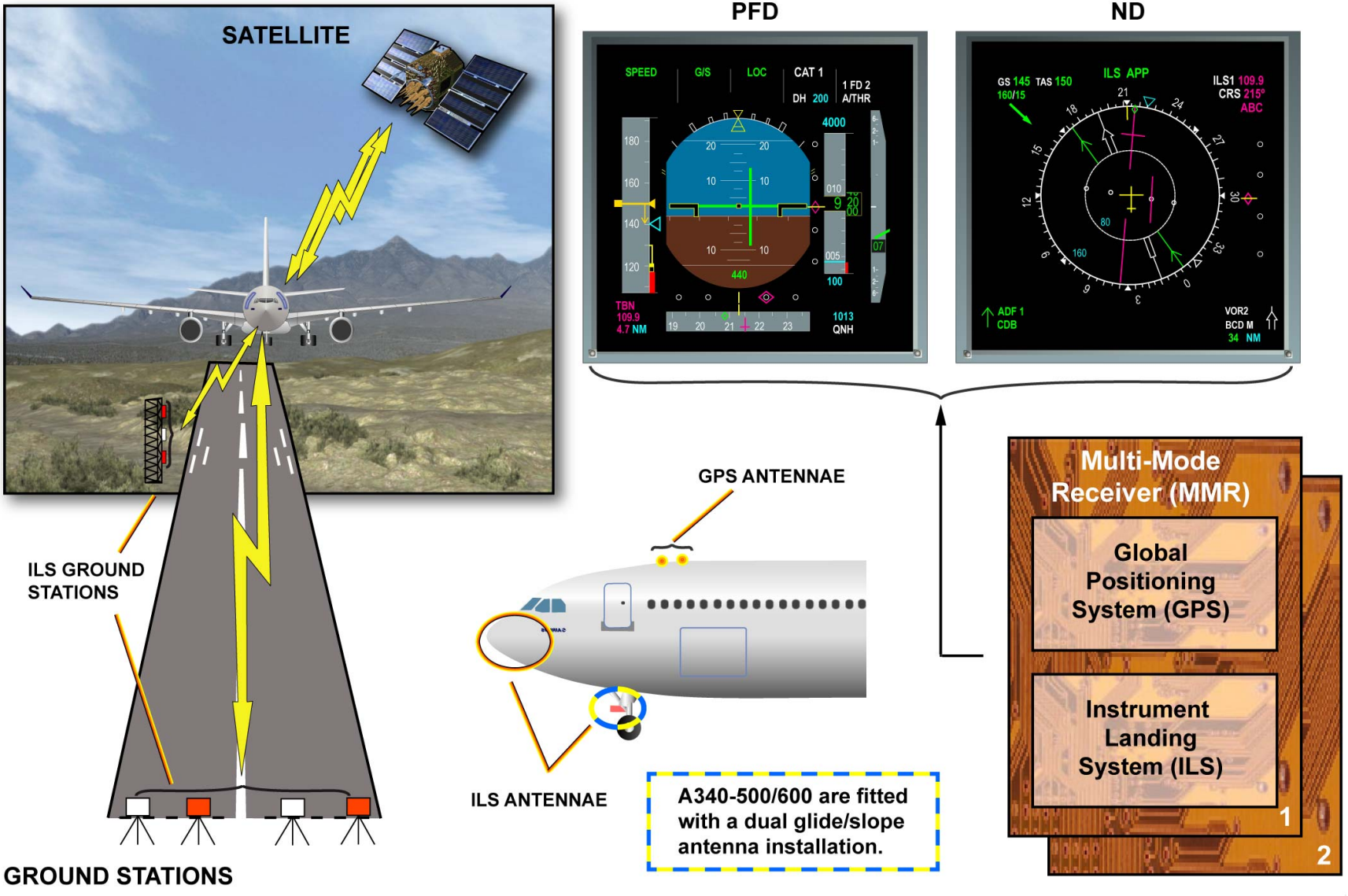
MMR D/O (3)

MMR

The aircraft has two Multi Mode Receivers (MMRs). The MMR is a single navigation receiver that includes two internal receivers:
- an ILS receiver,
- a GPS receiver.

The primary function of the MMR is to receive and process ILS and GPS signals.

G9409341 - GAUT0T0 - FM34DD000000001



MMR

G9409341 - GAUT0T0 - FM34DD000000001

MMR D/O (3)

ILS FUNCTION

The ILS function is to provide the crew and airborne system users with lateral (LOCalizer (LOC)) and vertical (Glide Slope (G/S)) deviation signals, with respect to the approach ILS radio beam transmitted by ground stations.

AUTO TUNING

In normal operation each Flight Management Guidance and Envelope Computer (FMGEC) automatically tunes its ownside ILS receiver through its ownside Radio Management Panel (RMP).

MANUAL TUNING

Each MCDU allows the ownside ILS receiver to be manually tuned through the ownside FMGEC and the opposite ILS receiver to be tuned through the opposite FMGEC.

FM SWITCHING

If an FMGEC failure occurs, a discrete, generated by the Flight Management (FM) switching, changes the tuning port of the associated ILS receiver, so that it can be directly tuned by the opposite FMGEC.

BACK-UP TUNING

If both FMGECs fail, each RMP allows its ownside receiver to be directly tuned.
If at least one FMGEC is valid, when the standby NAV is activated, the RMP sends a discrete to the FMGECs to inhibit the FMGEC auto and manual tuning as well as the MCDU radio NAV page display.
The ILS data is exchanged between the RMPs if both are in NAV configuration.

ANTENNAE

The two G/S and the LOC antennae are common to both receivers. Each antenna has two independent connectors, used for feeding the two ILS receivers.
Only one of the signal source of both G/S antennae is used by the Multi-Mode Receivers (MMRs). The Radio Frequency (RF) relays allow the selection of either:
- the capture antenna, which is used by the MMR receivers to compute the glide deviation when the NLG is not extended and according to other conditions,
- the track antenna, which is used by the MMR receivers to compute the glide deviation when the NLG is extended and according to other conditions.

NOTE: Note: the track antenna is installed on the A340-500/600 only.

The selection of the G/S antenna is based on two discrete inputs:
- the Landing Antenna Select (LAS) input,
- the Functional Test (FT) input.

These two discrete inputs, provided by the FMGECs, inform the MMR receivers about the same type of information, i.e. the NLG extension status combined with conditions as, for instance, the radio-altimeter altitude. According to the state of these discretes, the MMRs command their corresponding RF relay switches on the proper G/S antenna and accordingly inform the MMRs through a VHF Antenna Select Acknowledge (VASA) discrete.

NOTE: Note: the glide capture antenna and the glide track antenna operate in the 329-335 Mhz range. The LOC antenna operates in the 108-112 Mhz range.

G9409341 - GAUT0T0 - FM34DD000000001

LGCIU

Each Landing Gear Control and Interface Unit (LGCIU) sends discrete signals to the associated ILS receiver. This ground / flight information is used by the receiver BITE module to count the flight legs.

INDICATING

The ILS data is sent to the displays through the Display Management Computers (DMCs). The ILS 1 data is sent to the CAPT PFD and F/O ND, while the ILS 2 data is sent to the F/O PFD and CAPT ND. The ILS audio signal is processed by the receivers and sent to the Audio Management Unit (AMU) and can be heard by the crew.

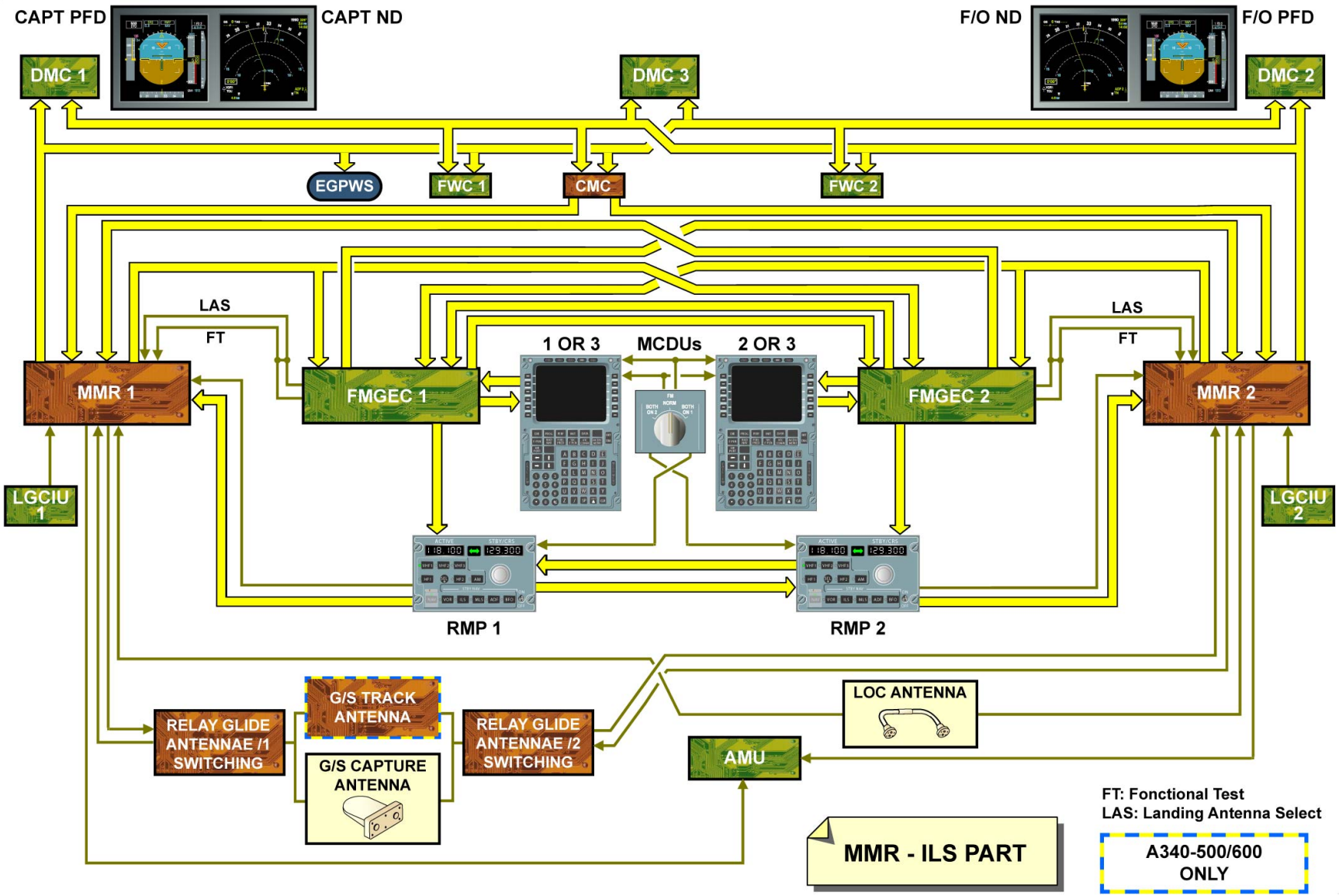
USERS

The ILS data is sent to the FMGEC for A/C guidance during take-off, approach and landing phases. This data is also sent to the ECAM via the Flight Warning Computers (FWCs). The ILS1 data is sent to the Enhanced Ground Proximity Warning System (EGPWS).

CMC

The MCDUs allow the system to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground.

G9409341 - GAUT0T0 - FM34DD000000001



ILS FUNCTION - AUTO TUNING ... CMC

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G9409341 - GAUT0T0 - FM34DD000000001

MMR D/O (3)

GPS FUNCTION

GPS OPERATION

The GPS function is achieved by two stand-alone satellite navigation receivers using the US GPS satellites constellation. The GPS primary function is to track the Radio Frequency (RF) signals received from the satellites, to compute its own position and to provide the GPS data to the FMGCs through the three Air Data/Inertial Reference Units (ADIRUs). Receiver Autonomous Integrity Monitoring (RAIM) or Autonomous Integrity Monitoring Extrapolation (AIME) provides integrity and availability of this data. The GPS function provides three-dimensional aircraft position, velocities and exact time used for hybrid computation
s by the three ADIRUs. In case of failure of one GPS function, the ADIRU automatically selects the only operative GPS function to compute hybrid GP-IRS data.
The GPS basically provides the ADIRUs with: position, altitude, and ground speed. The ADIRUs send pure inertial position, pure GPS position, and a mixed inertial/GPS position to the FMGEC which uses this data to compute the aircraft present position.

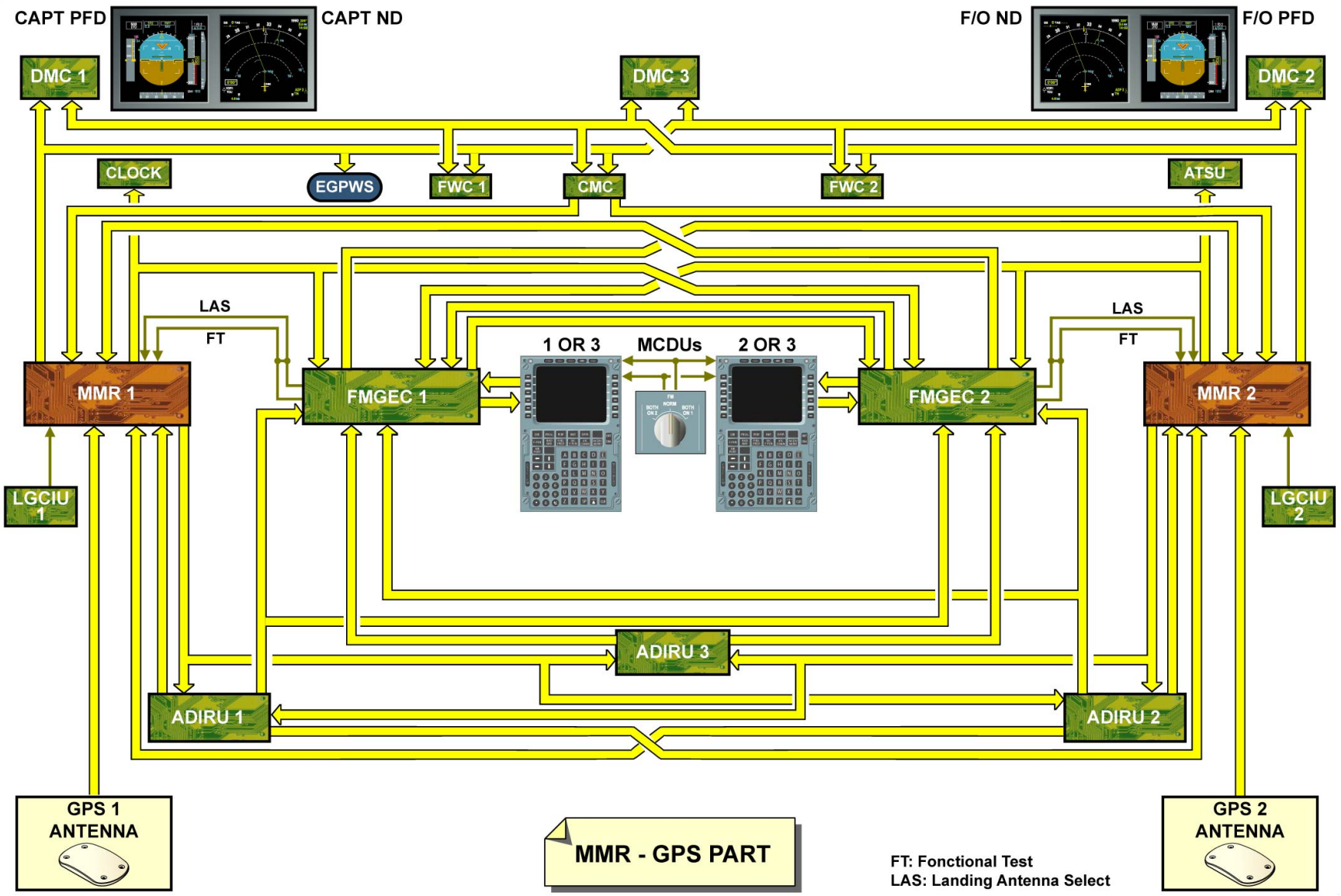
ANTENNAE

The GPS antenna is an L-band active antenna, with an integrated preamplifier and filter, providing an omni-directional upper hemispheric coverage. The GPS antenna operates at a frequency of 1575.42 MHz called L1. A second frequency of 1227.6 MHz, called L2, is used to estimate the propagation error of L1 and to suppress it.

USERS

- ADIRU: ADIRU 1and 3 gets its data from MMR 1 and ADIRU 2 gets its data from MMR 2 under normal conditions. In case of a MMR/GPS failure the ADIRU automatically selects the available MMR/GPS input.
- CLOCK: Receives GPS time and date information.
- ATSU: Receive GPS time and date.

G9409341 - GAUT0T0 - FM34DD000000001



GPS FUNCTION - GPS OPERATION ... USERS

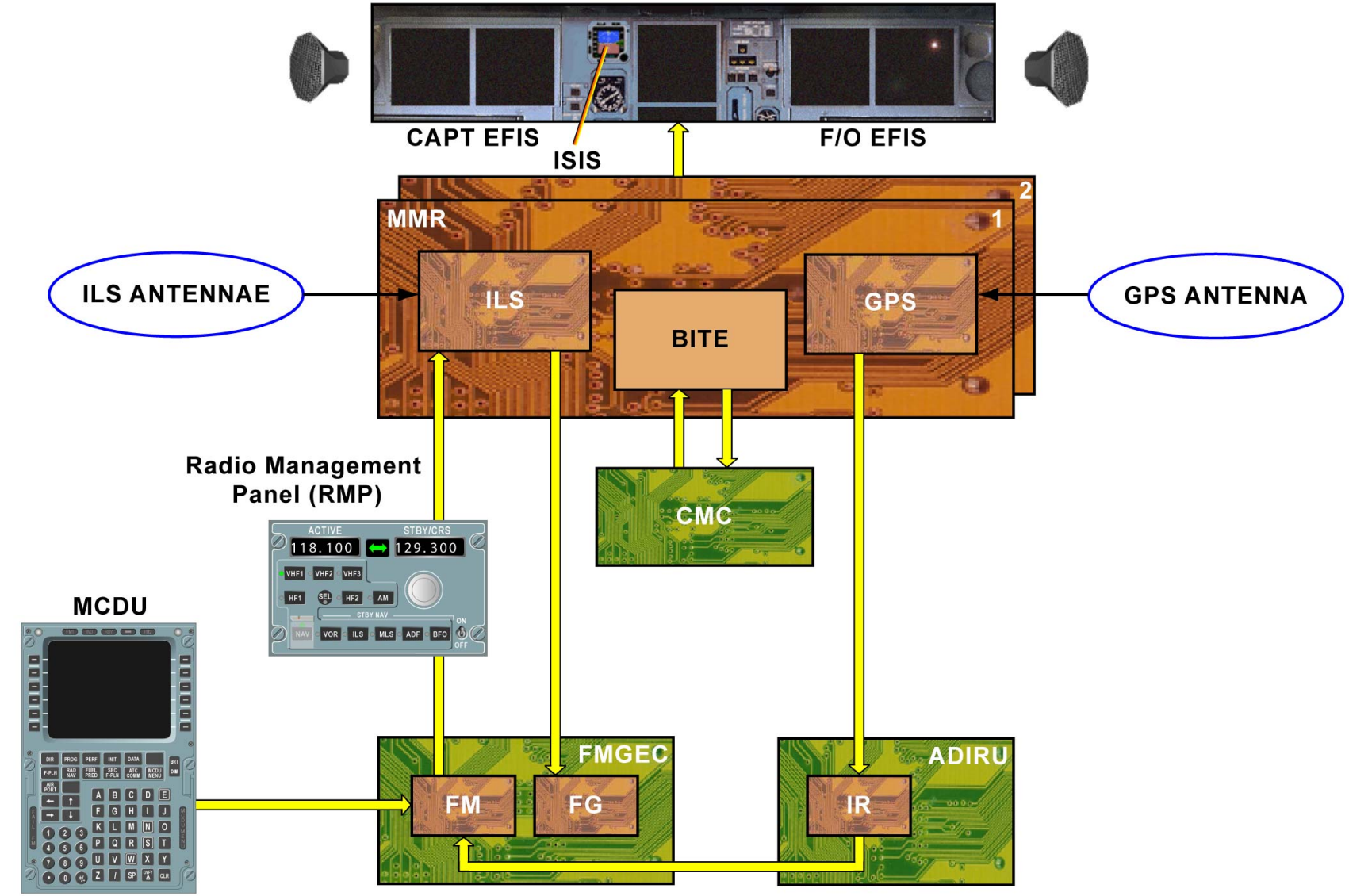
G9409341 - GAUT0T0 - FM34DD000000001

MMR D/O (3)

MAINTENANCE OPERATION

The MMR is fitted with a BITE which detects and identifies failures. The MMR is connected to the Central Maintenance Computer (CMC) for onboard testing and fault reporting purposes.

G9409341 - GAUT0T0 - FM34DD000000001



MAINTENANCE OPERATION

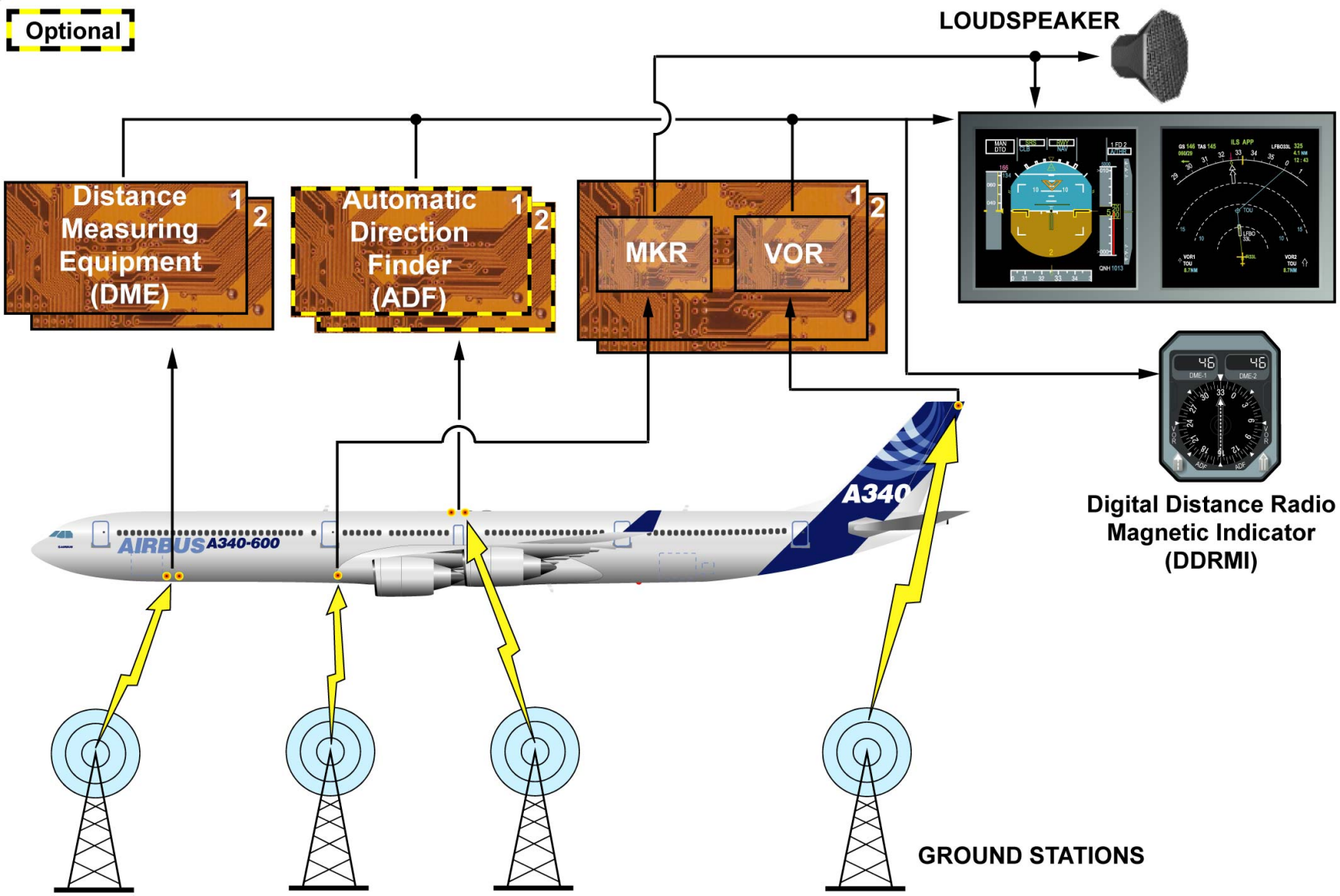
G9409341 - GAUT0T0 - FM34DD000000001

VOR/MKR-DME-ADF D/O (3)

GENERAL

The Very high frequency Omni directional and radio Range (VOR), Distance Measuring Equipment (DME), Automatic Direction Finder (ADF), and MARKER systems are radio navigation aids, which compute navigation data (bearing, slant distance) from ground stations.

G9409341 - GAUT0T0 - FM34D6000000002



GENERAL

G9409341 - GAUT0T0 - FM34D6000000002

VOR/MKR-DME-ADF D/O (3)

ADF PRINCIPLE

The ADF is a radio navigation aid, which receives and interprets the signals provided by a Non-Directional Beacon (NDB) at a ground station. A Morse signal is also provided to identify the selected ground station. The ADF provides a relative bearing to the instruments.

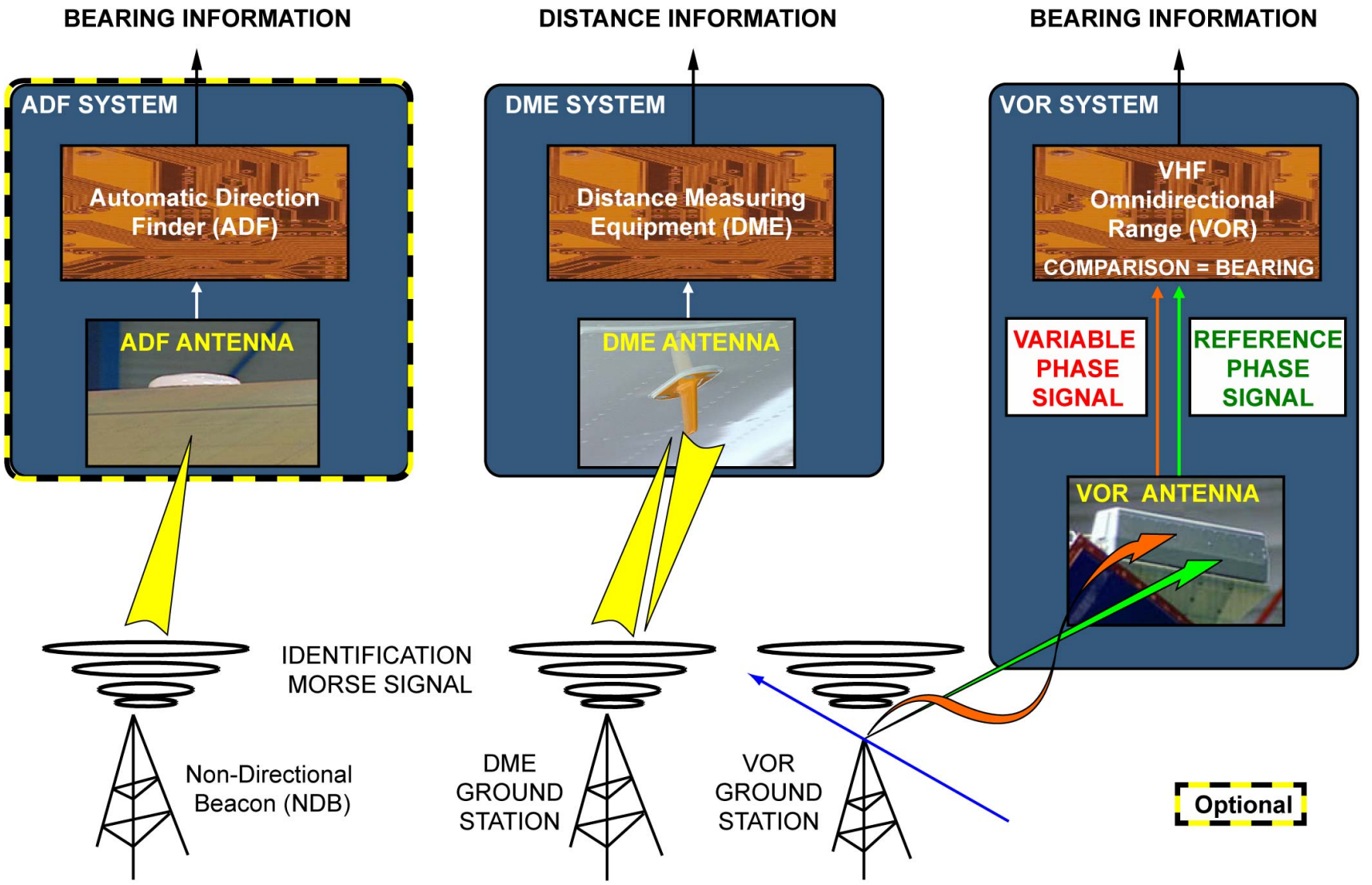
DME PRINCIPLE

The DME provides a digital readout of the aircraft slant range distance from a selected ground station. The system generates interrogation pulses and sends them to the DME ground station. The interrogator determines the distance in nautical miles (Nm) between the station and the aircraft. It also detects the Morse audio signal which identifies the ground station.

VOR PRINCIPLE

The VOR system is a navigation aid which receives, decodes and processes signals received from the omni directional ground station. The VOR system provides the bearing information from the difference between two signals transmitted by the ground station. It also provides:
- a Morse signal which identifies the station,
- the aircraft angular deviation and from/to position with respect to a selected course.

G9409341 - GAUT0T0 - FM34D6000000002



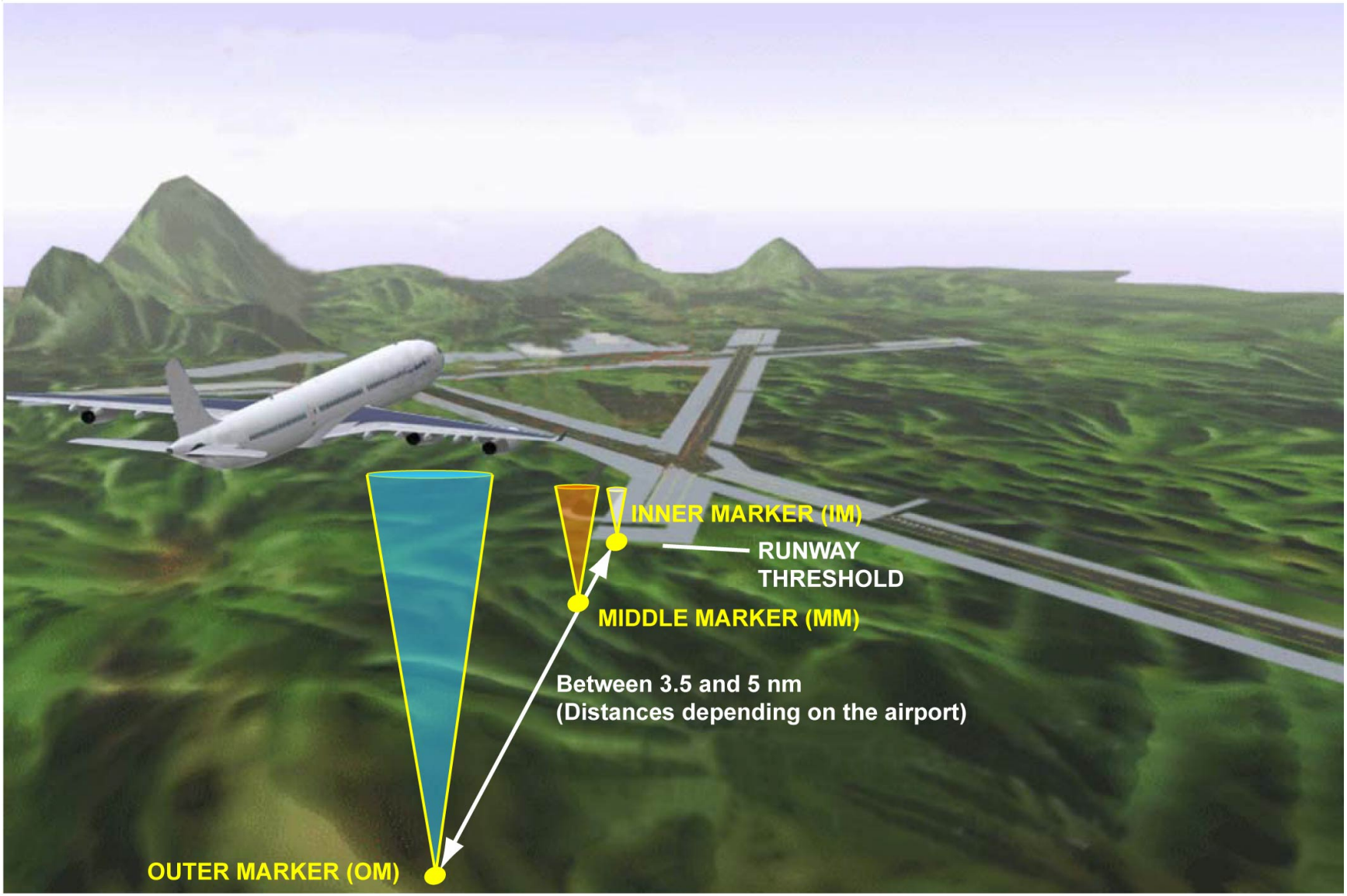
ADF PRINCIPLE ... VOR PRINCIPLE

VOR/MKR-DME-ADF D/O (3)

MARKER PRINCIPLE

The MARKER system is a radio navigation aid, which provides indicators related to the distance between those marker signals and the runway threshold. These signals are transmitted vertically and if visualized appear as a cone radiating from the station. When the aircraft overflies one of the MARKER transmitters, the system provides aural and visual indications to the flight crew.

G9409341 - GAUT0T0 - FM34D6000000002



MARKER PRINCIPLE

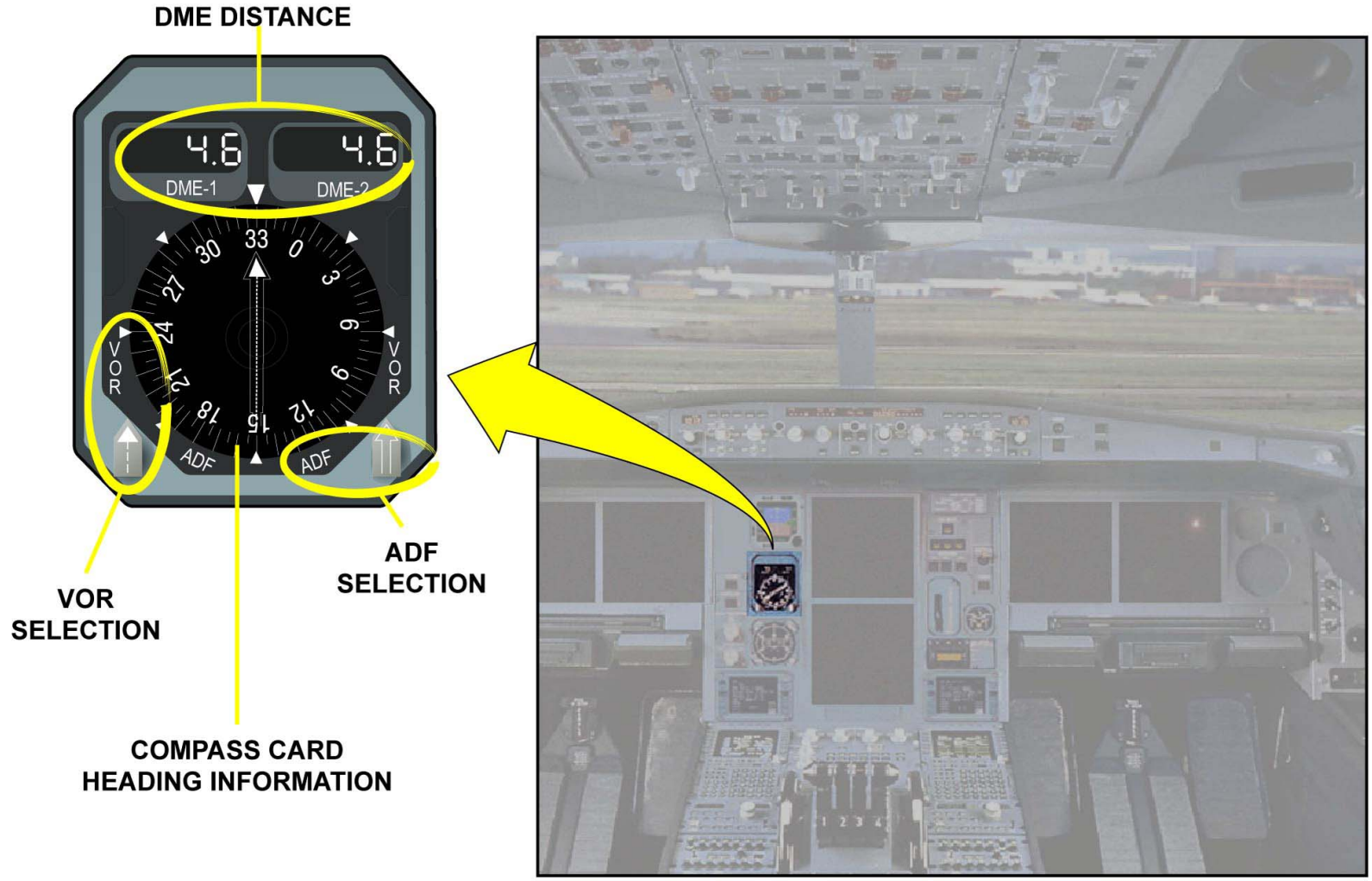
G94093341 - GAUT0T0 - FM34D6000000002

VOR/MKR-DME-ADF D/O (3)

DDRMI PRESENTATION

The Digital Distance Radio Magnetic Indicator (DDRMI) is mounted on the forward instrument panel. This instrument provides the crew with the following information:
- DME distance,
- VOR bearing,
- ADF bearing,
- heading information.

G9409341 - GAUT0T0 - FM34D6000000002



DDRMI PRESENTATION

G9409341 - GAUT0T0 - FM34D6000000002

VOR/MKR-DME-ADF D/O (3)

VOR/MKR-ADF-DME-DDRMI OPERATION

The tuning of the ADF, DME and VOR/MKR receivers is identical. In normal operation the Flight Management Guidance and Envelope Computers (FMGECs) automatically tune the receivers via their associated Radio Management Panels (RMPs). Each MCDU allows the receiver to be manually tuned through the FMGEC.
If both FMGECs fail, the RMPs enable the receivers to be tuned in backup mode. The data is sent to the EFIS and to the DDRMI. The audio signal (Morse signal) processed by the receivers is sent to the Audio Management System and can be heard by the crew.
It is possible to test the systems through the Central Maintenance Computer (CMC) by using the MCDU CMC function on the ground.

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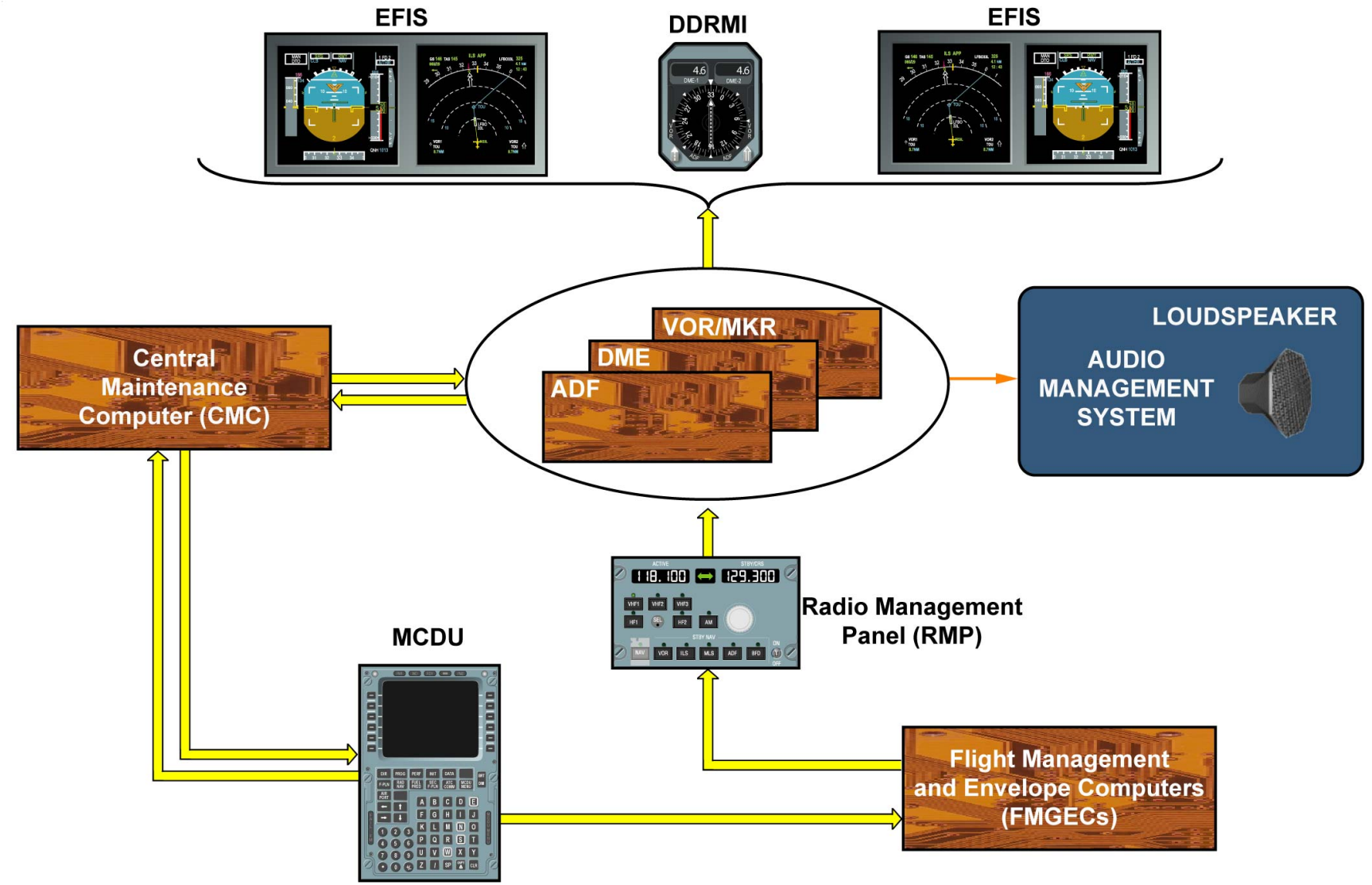

VOR/MKR-ADF-DME-DDRMI OPERATION

VOR/MKR-DME-ADF D/O (3)

AUTO TUNING

In normal operation each Flight Management Guidance and Envelope Computer (FMGEC) automatically tunes its ownside VOR receiver, DME interrogator and ADF receiver through its ownside Radio Management Panel (RMP). The VOR transceiver start-up system is ensured by a discrete signal.

MANUAL TUNING

Each MCDU allows the ownside VOR receiver, DME interrogator and ADF receiver to be manually tuned through the ownside FMGEC and the opposite system units to be tuned through the opposite FMGEC.

FLIGHT MANAGEMENT SWITCHING

If a FMGEC failure occurs, a discrete, generated by the Flight Management (FM) switching, changes the tuning port of the associated VOR receiver, DME interrogator and ADF receiver so that they can be directly tuned by the opposite FMGEC.

BACK-UP TUNING

If both FMGECs fail, each RMP allows its ownside VOR receiver, DME interrogator and ADF receiver to be directly tuned after selection of the NAV mode. If at least one FMGEC is valid, when the STandBY NAVigation is activated, the RMP sends a discrete to the FMGEC to inhibit the FMGEC auto and manual tuning as well as the MCDU radio NAV page.

ANTENNA

The dual VOR antenna receives the signals coming from the ground stations. The VOR antenna has two independent connectors used to feed the two VOR systems. It operates in the 108 MHz to 118 MHz range.

The MKR system consists of two identical VOR/MKR receivers but only MKR one is operative as connected to the MKR antenna. The MKR system operates at a fixed frequency. The MKR antenna receives MKR signals when the A/C overflies the MKR beacons. The MKR antenna operates at 75 MHz.

The DME antenna transmits the DME interrogation and receives the reply from the selected ground station. The DME and ATC use identical and interchangeable blade antennae, designed for operation between 962 MHz and 1213 MHz. The DME, the ATC and Traffic Alert and Collision Avoidance System (TCAS) operate with interrogation/reply pulses in the same frequency range. The suppressor signal is transmitted by the operating system during each pulse to inhibit the other systems and to prevent simultaneous transmission.

The ADF antenna provides three signals and consists of one sense antenna and two loop antennae called longitudinal antenna and lateral antenna. The ADF antenna operates between 150 kHz and 1799 KHz and comprises one pre-amplifier for each antenna that is energized by the ADF receiver and a test loop which enables a self-test of the antenna although it is not used.

INDICATING

The DME data is sent to the PFD and the ND through the Display Management Computers (DMCs) and directly to the Digital Distance and Radio Magnetic Indicator (DDRMI). The ADF and VOR data is sent to the ND through the DMC and directly to the DDRMI. The MKR data is sent to the PFD through the DMC. The VOR, MKR, DME and ADF audio signals are processed by their corresponding receivers and sent to the Audio Management Unit (AMU) and can be heard by the crew.

LGCIU

Each Landing Gear Control and Interface Unit (LGCIU) sends discrete signals to the associated DME interrogator, ADF receiver and VOR

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receiver. This ground/flight information is used by the receiver BITE module to count the flight legs.

FMGEC

The VOR and DME data are sent to the FMGECs respectively for aircraft position and radio distance computation.

CMC

The MCDUs allow the systems to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground.

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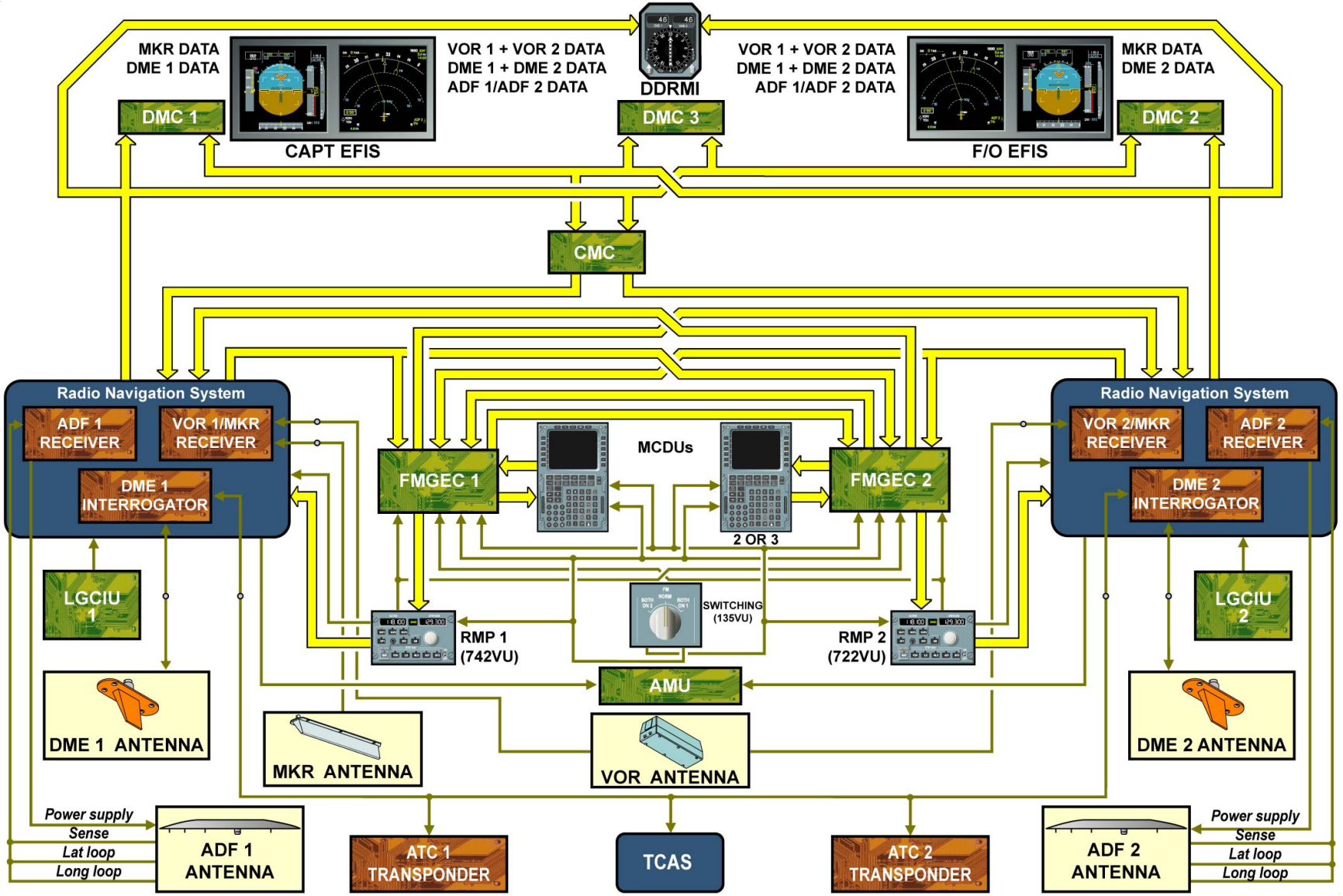

AUTO TUNING ... CMC

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TAWS/EGPWS/T2CAS D/O (3)

GENERAL

This module describes in detail the functions of the Terrain Awareness and Warning System (TAWS). The TAWS is an improved system over the former Ground Proximity Warning System (GPWS). The TAWS is also known as the Enhanced Ground Proximity Warning System (EGPWS) or Terrain and Traffic Collision Avoidance System (T2CAS).

DATA INPUTS

DIGITAL INPUTS

The TAWS receives digital data inputs as follows:
- serial digital data inputs from the Radio Altitude (RA) 1, the Multi-Mode Receiver (MMR) 1-ILS (Glide/Slope deviation, localizer deviation and runway heading) through ARINC 429 bus (Low Speed),
- Air Data/Inertial Reference Unit (ADIRU) 1- Inertial Reference (IR) with Inertial Reference System (IRS) mode, ground speed, true track, true heading, roll angle, flight path angle, latitude and longitude through ARINC 429 bus (High Speed),
- ADIRU 1- Air Data Reference (ADR) with computed airspeed, barometric altitude, altitude rate and SAT through ARINC 429 bus (LS),

The Flight Control Unit (FCU) 1 and 2 give range and baro setting through LS ARINC 429 bus. The Flight Management Guidance and Envelope Computer (FMGEC) 1 gives navigation data through HS ARINC 429 and some other data through a LS bus.
- the Central Maintenance Computer (CMC) gives maintenance data through a LS speed ARINC 429 bus. The CMC receives, during the flight, the status of the EGPWS from the BITE module. The MCDUs allow the systems to be tested via the CMC. The tests are only available on ground.

DISCRETE INPUTS

The TAWS also receives discrete data inputs. The flap position from the Slats and Flap Control Computer (SFCC) 1 consolidated with MCDU selection for landing. To avoid nuisance warnings during approach, the EGPWC needs to know at which flap position the crew intends to land. If the FLAP 3 position is selected from one MCDU, FMGEC 1 or 2 activates a relay, which selects the ground signal from SFCC 1.
The FWCs send a discrete to the EGPWC to inhibit all warnings when a stall or windshear warning is triggered.
The Landing Gear Control and Interface Unit (LGCIU) sends a discrete signal to the EGPWC. The LGCIU sends ground/flight information to the EGPWC BITE module, which uses this information to count the flight legs.
The TAWS also receives other discrete inputs from:
- the ECAM Control Panel (ECP) for audio cancel,
- the GPWS control panel to override or inhibit modes 1 to 5,
- the PULL UP/GPWS P/BSW to enable self test on ground or cancel mode 5 in flight,
- Weather Radar (WXR) control unit for ON/OFF indication.

VISUAL WARNINGS

Two fault annunciators indicate system failures on the EGPWS control panel. Hazardous configuration warning annunciators are installed on the main instrument panel. Four discretes control the warning legends:
- one for red PULL UP legends, for ground proximity warning modes 1 to 4 or enhanced features warnings,
- one for amber GPWS legends, for Glide/Slop (G/S) advisory alert for mode 5,
- one monitor output for the amber FAULT legend of the GPWS/SYS P/B to indicate a mode 1 to 5 failure and send the "GPWS FAULT" ECAM message via the System Data Acquisition Concentrator (SDAC),

G9409341 - GAUT0T0 - FM34D8000000002

- one TERRain monitor output for the amber FAULT legend of the GPWS/TERR P/B to indicate an enhanced function failure and send the "GPWS TERR DET FAULT" ECAM warning message.

AURAL WARNINGS

The cockpit loudspeakers use the audio output via the Audio Management Unit (AMU) for transmission of aural warning messages. The EGPWC or T2CAS computer receives a discrete signal from the ECAM Control Panel (ECP), which lets the crew cancel the audio transmission.

EGPWS CONTROL

Different P/Bs let the crew control the actions of the EGPWS. When pressed in, on the GPWS panel, the SYS P/B inhibits all the GPWS warnings, the G/S MODE P/B inhibits the G/S mode and the FLAP MODE P/B inhibits flap abnormal condition input and sends the "GPWS FLAP MODE OFF" ECAM message. When pressed in, the TERR P/B in white legend inhibits the terrain awareness.
When pressed in, the CAPT or F/O PULL UP/GPWS P/B cancels the G/S mode or starts the self-test sequence (on ground). When the TERR ON ND P/B is pressed in, on the center instrument panel, the green ON legend comes on. This indicates that terrain data is displayed on the ND (following manual or automatic pop-up selection).
The enhanced functions are GPWS added functions, which automatically display, on the NDs, the terrain data, in place of the radar image, when a terrain caution or warning is detected or at any time by using the TERR ON ND P/B. If the optional predictive windshear is activated, the predictive windshear alerts have priority over EGPWS modes.
Different output signals are sent from the EGPWC or T2CAS to other systems. One bus output is used by the Aircraft Condition Monitoring System (ACMS) through the Flight Data Interface and Management Unit (FDIMU). One discrete output is used for the Digital Flight Data Recorder (DFDR) via Flight Warning Computers (FWCs) 1 and 2. Two discrete outputs are used to inhibit Traffic alert and Collision Avoidance System (TCAS) and automatic call-out when the GPWS or G/S warnings are in progress.

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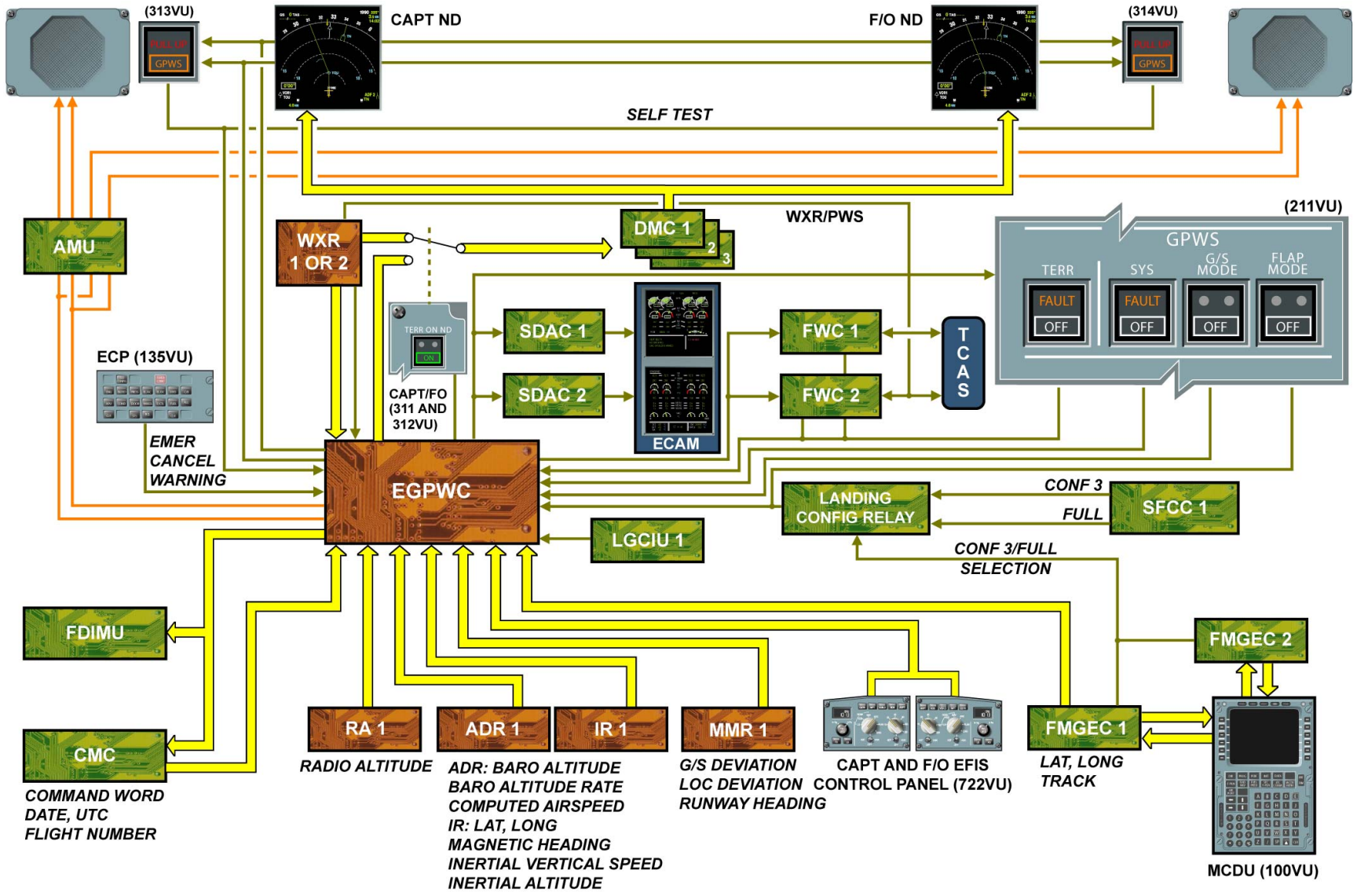

GENERAL ... EGPWS CONTROL

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TAWS/EGPWS/T2CAS D/O (3)

RUNWAY AWARENESS AND ADVISORY SYSTEM (OPTION)

In addition, the Runway Awareness and Advisory System (RAAS) is an optional software enhancement hosted in the EGPWS Unit. The RAAS uses GPS position data and the EGPWS Database to send aural advisories for flight crew awareness during ground operations and on approach to landing to avoid runway incursions or collisions. The RAAS operates automatically without any necessary action from the flight crew. An EGPWS self test can make sure that this function is available.
RAAS aural advisory priority:
- Approaching Runway In Air,
- Approaching Short Runway In Air,
- On Runway,
- Insufficient Runway Length On Ground,
- Approaching Runway On Ground,
- Taxiway Take Off,
- Extended Holding,
- Runway End.

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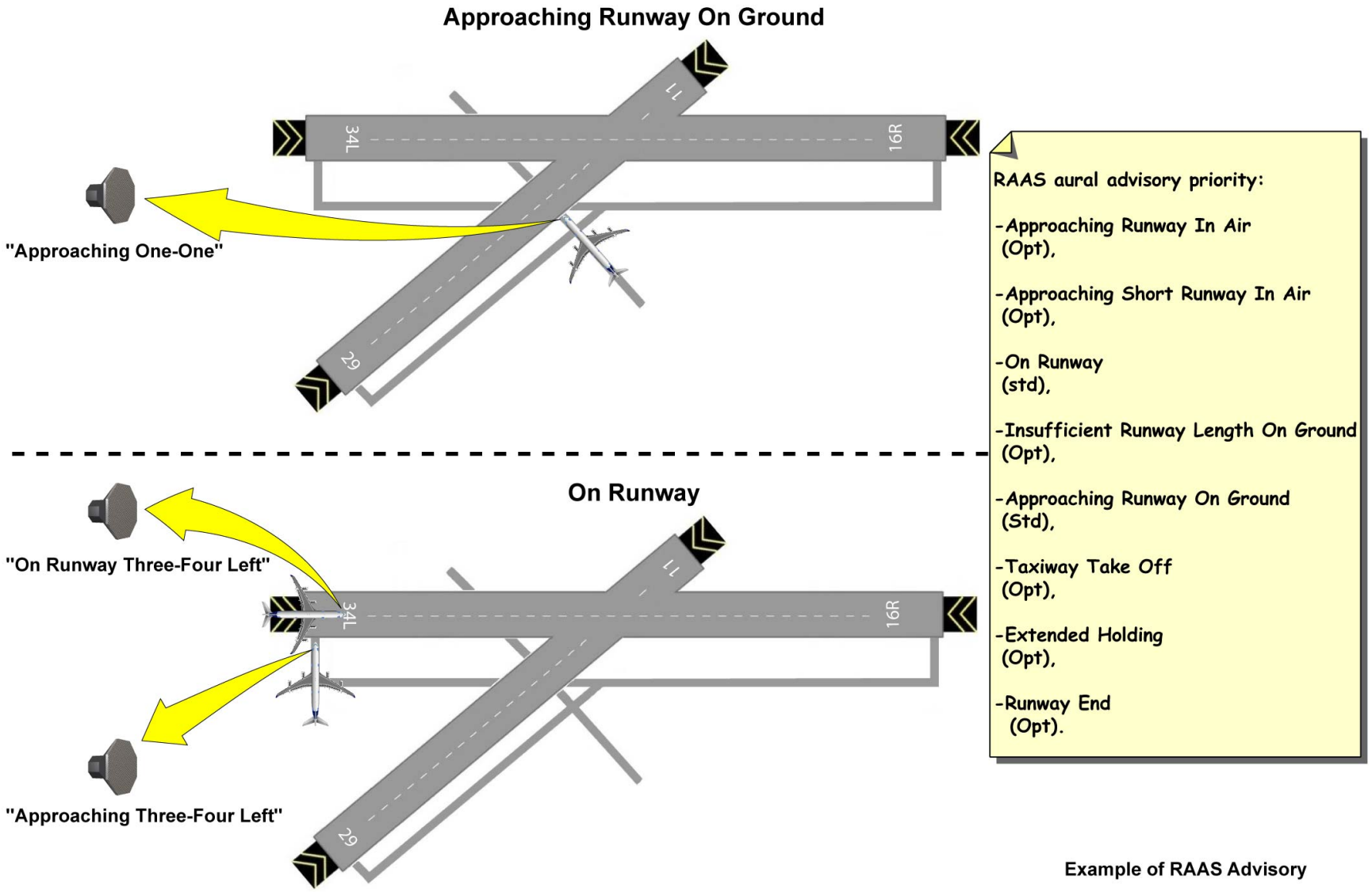

Example of RAAS Advisory

RUNWAY AWARENESS AND ADVISORY SYSTEM (OPTION)

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TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES

The digital and discrete data inputs are used in different combinations to monitor A/C vertical path. If the warning envelope is entered, visual and aural warnings are started. The aural messages are broadcasted, and visual warnings are indicated by the EGPWS lights. Modes 1 to 5 are the basic GPWS modes.

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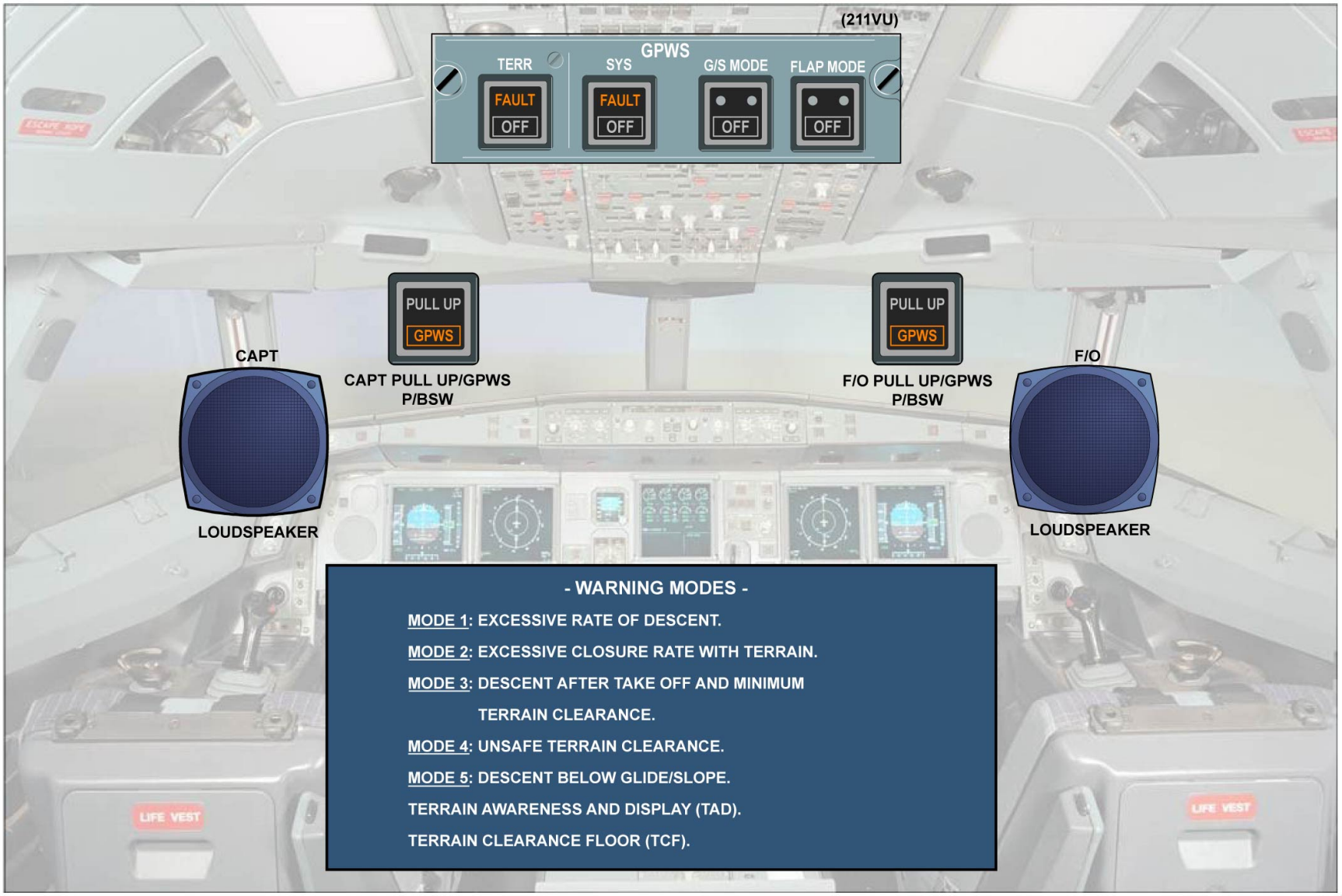

WARNING MODES

G9409341 - GAUT0T0 - FM34D8000000002

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

MODE 1

Mode 1 starts an alert warning for high descent rate towards terrain and for fast increasing sink rates near the runway at landing. These alerts will continue until the boundary penetration is corrected.

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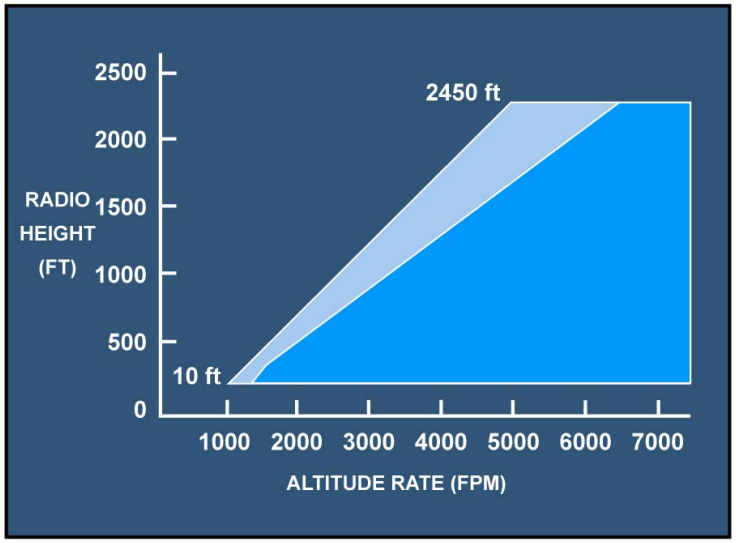

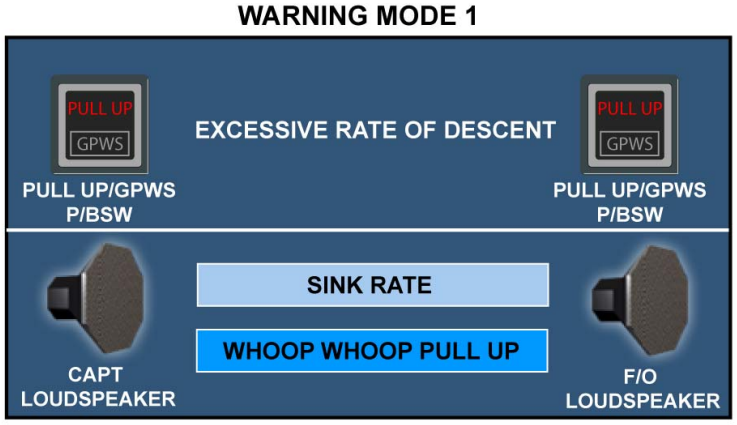

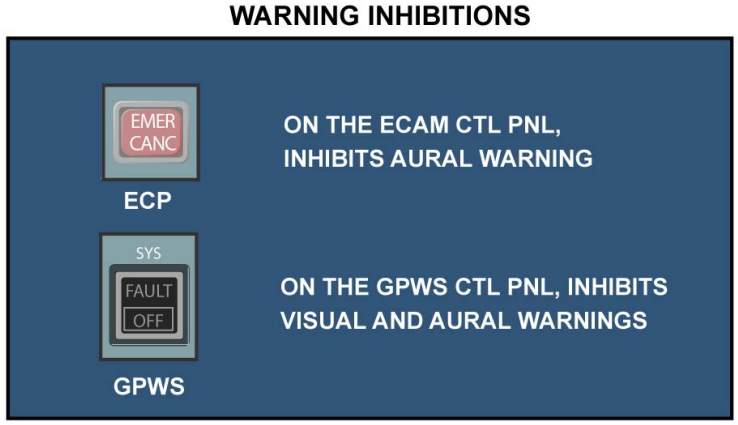

WARNING MODES - MODE 1

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

MODE 2

Mode 2 starts a warning based on the radio height and on how quickly the radio height decreases. Mode 2B asks the FLAPS to be in landing configuration or the A/C to be in G/S beam within +/- 2 dots of deviation during an ILS approach. After leaving the warning area, the repeated "TERRAIN" message will persist until an increase of baro altitude of 300 ft is obtained.

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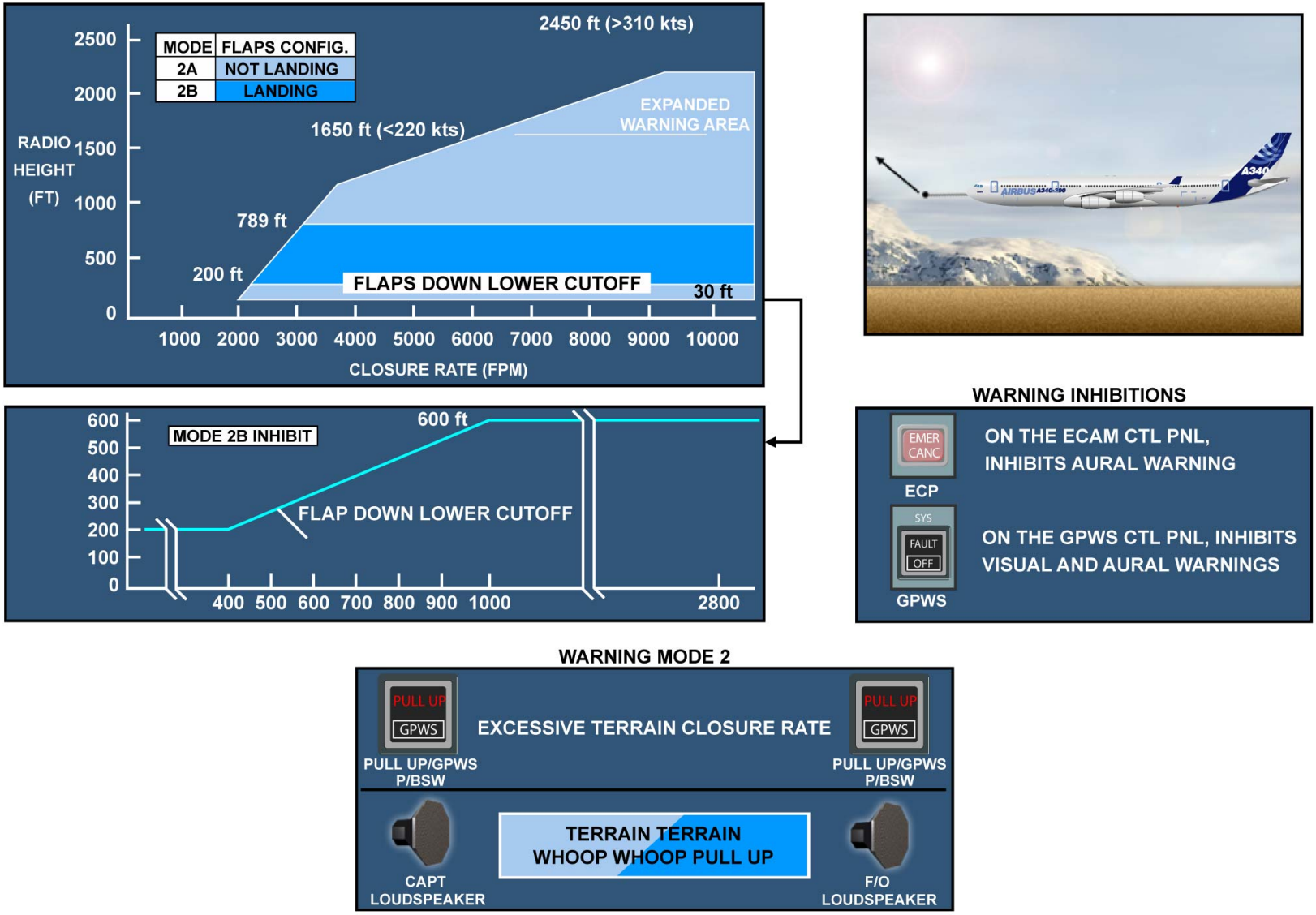

WARNING MODES - MODE 2

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

MODE 3

Mode 3 starts a warning for excessive altitude loss after take-off.

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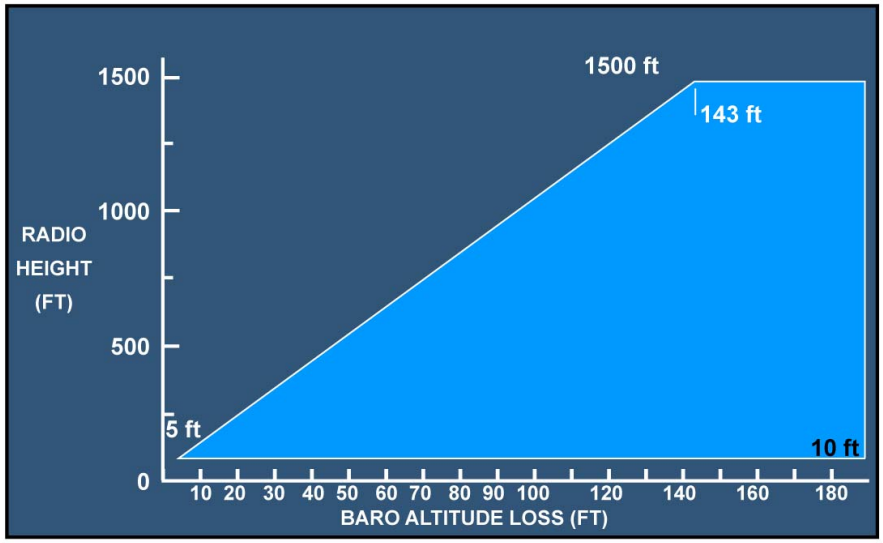

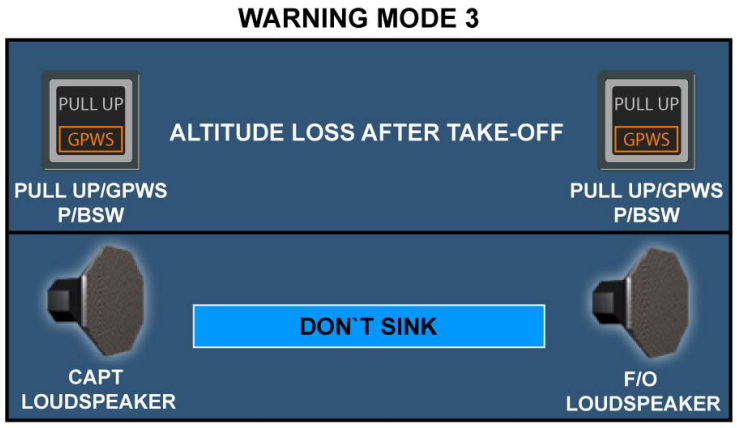

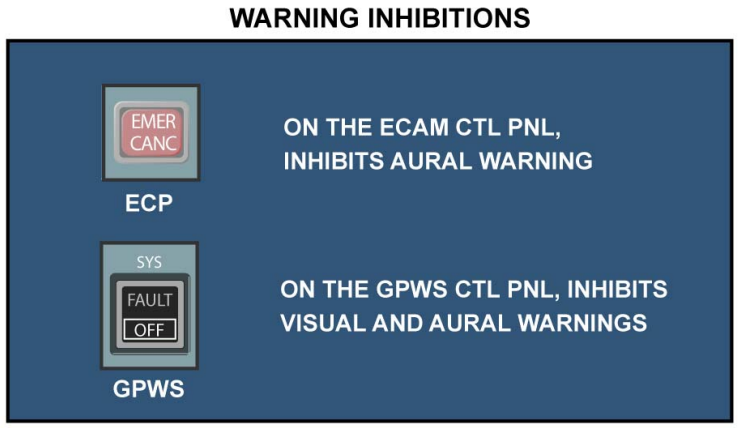

WARNING MODES - MODE 3

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

MODE 4

Mode 4 gives three types of voice warning based on the radio height, computed airspeed, and A/C configuration. The "TOO LOW GEAR" message warning has priority over the other two messages.

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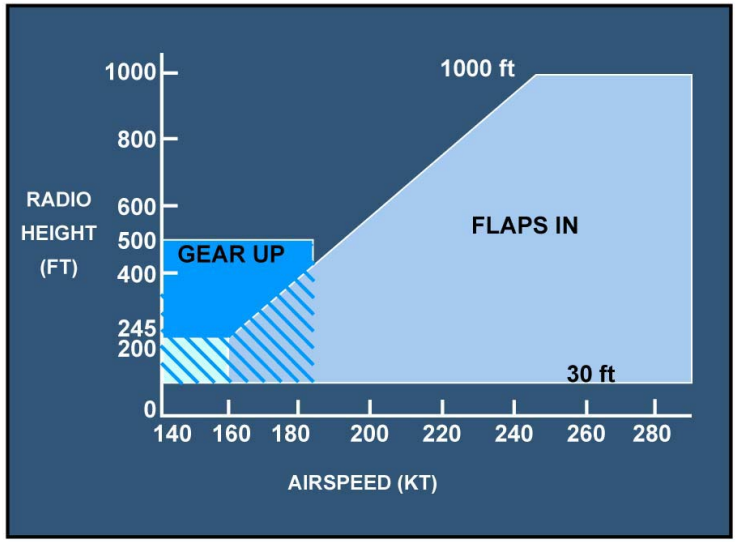
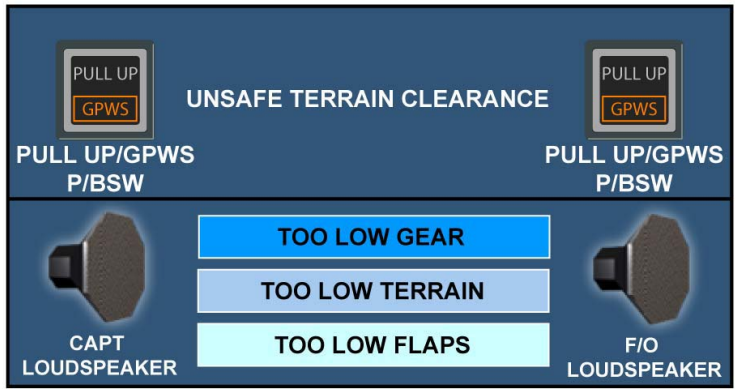
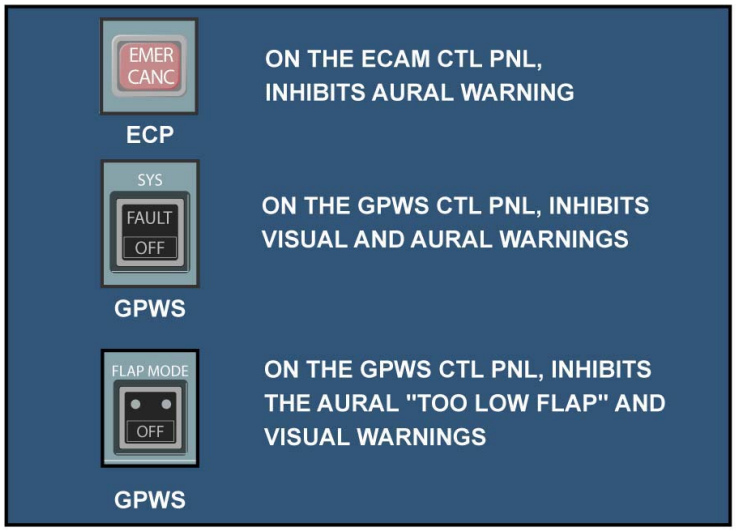


WARNING MODE 4



WARNING INHIBITIONS



WARNING MODES - MODE 4

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

MODE 5

Mode 5 starts two levels of warning when the A/C flight path descends below the G/S beam during ILS approaches.

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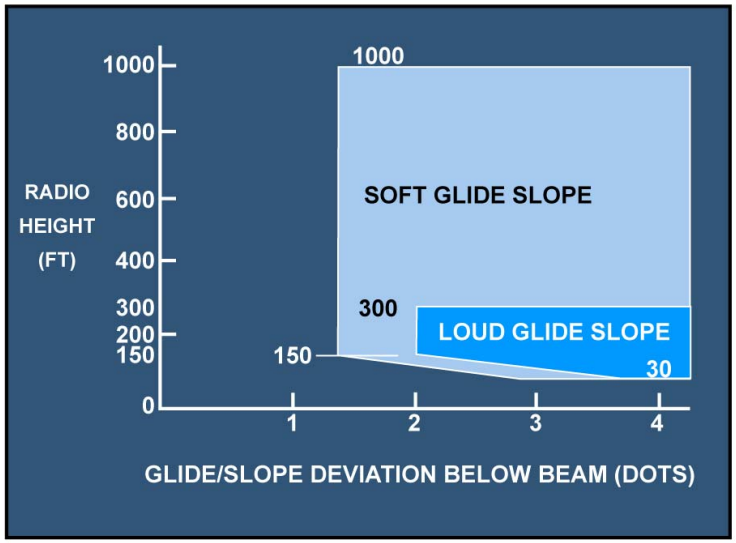

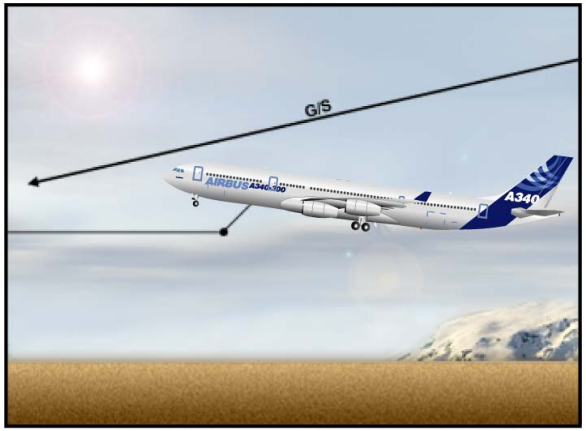

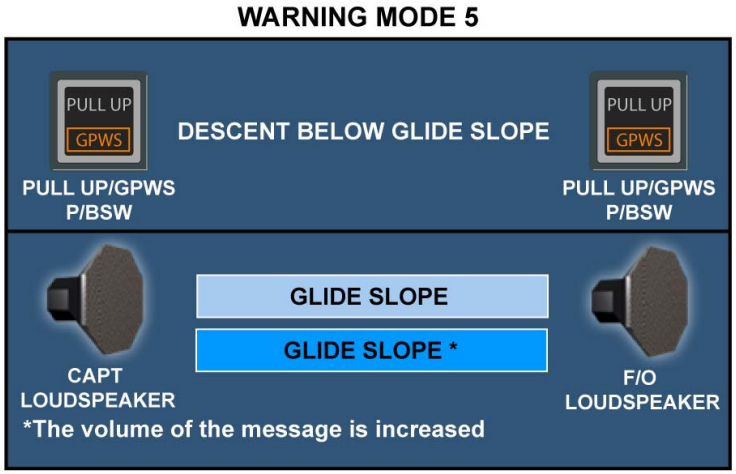

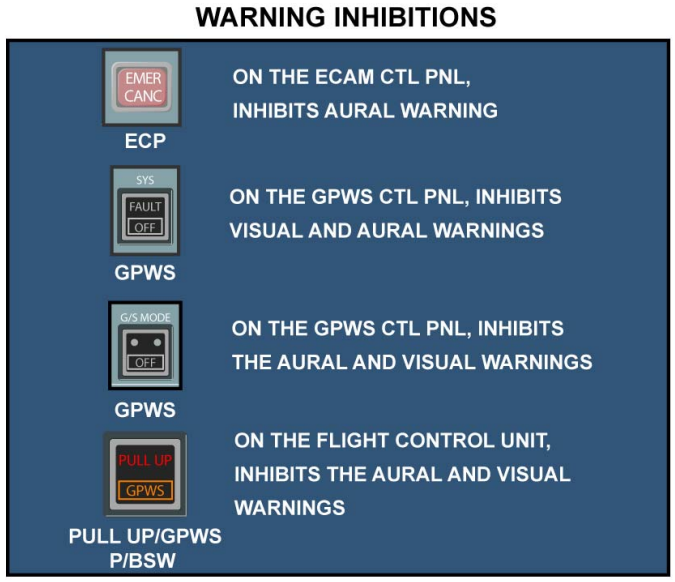

WARNING MODES - MODE 5

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

TERRAIN AWARENESS AND DISPLAY (TAD)

In addition to the basic GPWS function, the EGPWS features predictive functions based on a worldwide terrain database. When a terrain threat FWD of the A/C path is detected, with respect to the A/C position and the local terrain database, caution and warning alerts are started. These alerts are followed by a terrain image on the NDs, a red area for warnings and a yellow area for cautions.
When the envelope boundaries are met, the following alerts are generated:
- terrain caution alert: "TERRAIN AHEAD, TERRAIN AHEAD" is broadcasted for Joint Aviation Authorities (JAA) regulations or "CAUTION TERRAIN, CAUTION TERRAIN" for Federal Aviation Administration (FAA) regulations,
- terrain warning alert: "TERRAIN AHEAD, PULL UP" is broadcasted for JAA regulations or "TERRAIN, TERRAIN, PULL UP" for FAA regulations.
- obstacle caution alert: "OBSTACLE AHEAD, OBSTACLE AHEAD" is broadcasted for JAA regulations or "CAUTION OBSTACLE, CAUTION OBSTACLE" for FAA regulations,
- obstacle warning alert: "OBSTACLE AHEAD, PULL UP" is broadcasted for JAA regulations or "OBSTACLE, OBSTACLE, PULL UP" for FAA regulations.

NOTE: The EGPWS also includes an obstacle database in which are recorded the man made obstacles. They are thought as terrain.

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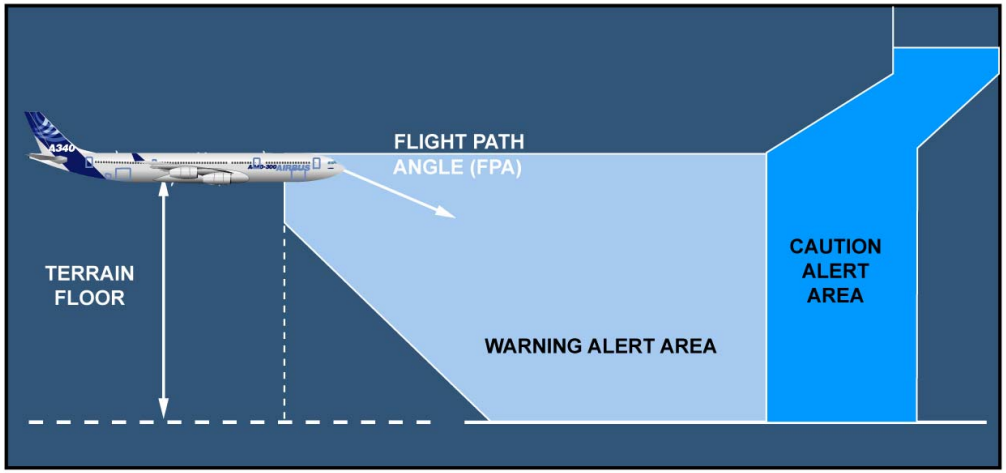
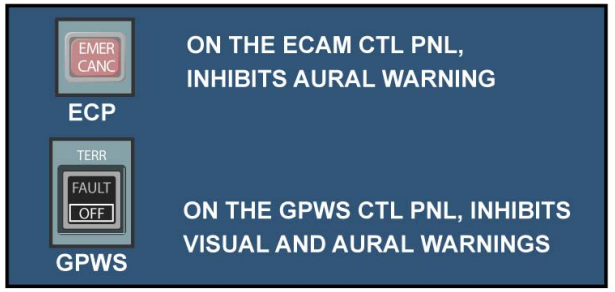
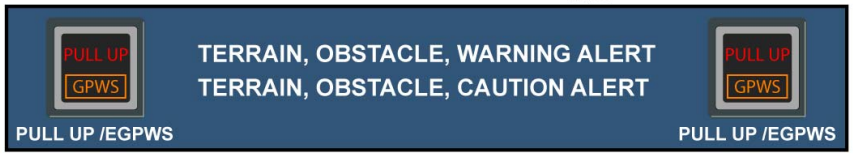


ENVELOPE BOUNDARIES

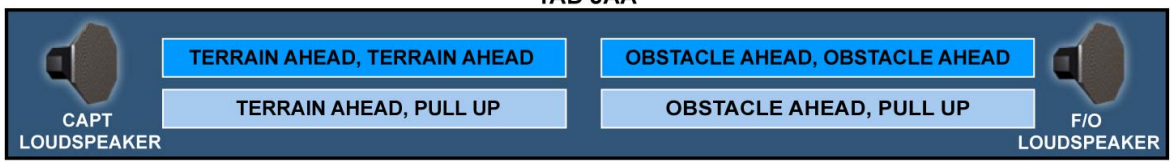


WARNING INHIBITIONS

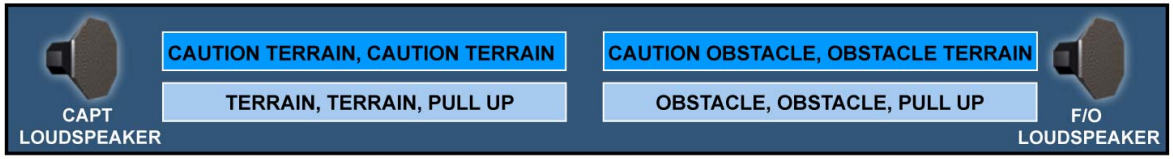
TAD



TAD JAA



TAD FAA



WARNING MODES - TERRAIN AWARENESS AND DISPLAY (TAD)

G9409341 - GAUT0T0 - FM34D8000000002

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

TERRAIN AWARENESS AND DISPLAY (TAD): BACKGROUND DISPLAY

The Terrain Awareness alerting and Display (TAD) function displays the background terrain and terrain alerts, FWD of the A/C, in the ROSE and ARC modes on the NDs. The background terrain display is depicted as variable density dot patterns in green, yellow or red depending on how far the terrain is from the altitude of the A/C . The Terrain is not shown if it is more than 2000 ft below the A/C altitude and if the terrain elevation is within 400 ft of the runway elevation nearest the A/C.

Depending on the conditions of terrain alert, the background image is enhanced to highlight the terrain threats by coloring them in solid yellow for the terrain caution alert and in solid red for the terrain warning alert. For the terrain or obstacle caution alert, that is 60 s from impact, the "TERRAIN AHEAD" or "OBSTACLE AHEAD" audio alert is repeated after 7 s if the A/C is still in the caution envelope. The amber GPWS caution comes on and an amber TERRain AHEAD or OBSTacle AHEAD message appears on the ND.

For the terrain or obstacle warning alert, that is 30 s from impact, the "TERRAIN AHEAD PULL UP" or "OBSTACLE AHEAD PULL UP" audio alert is repeated continuously while the A/C is in the warning envelope. The PULL UP red warning comes on and a red TERRain AHEAD or OBST AHEAD message appears on the ND.

The peaks mode enables the display of the absolute terrain elevation according to the range, including the display of two numerical values in a box, which indicate the highest and lowest elevation in the selected range.

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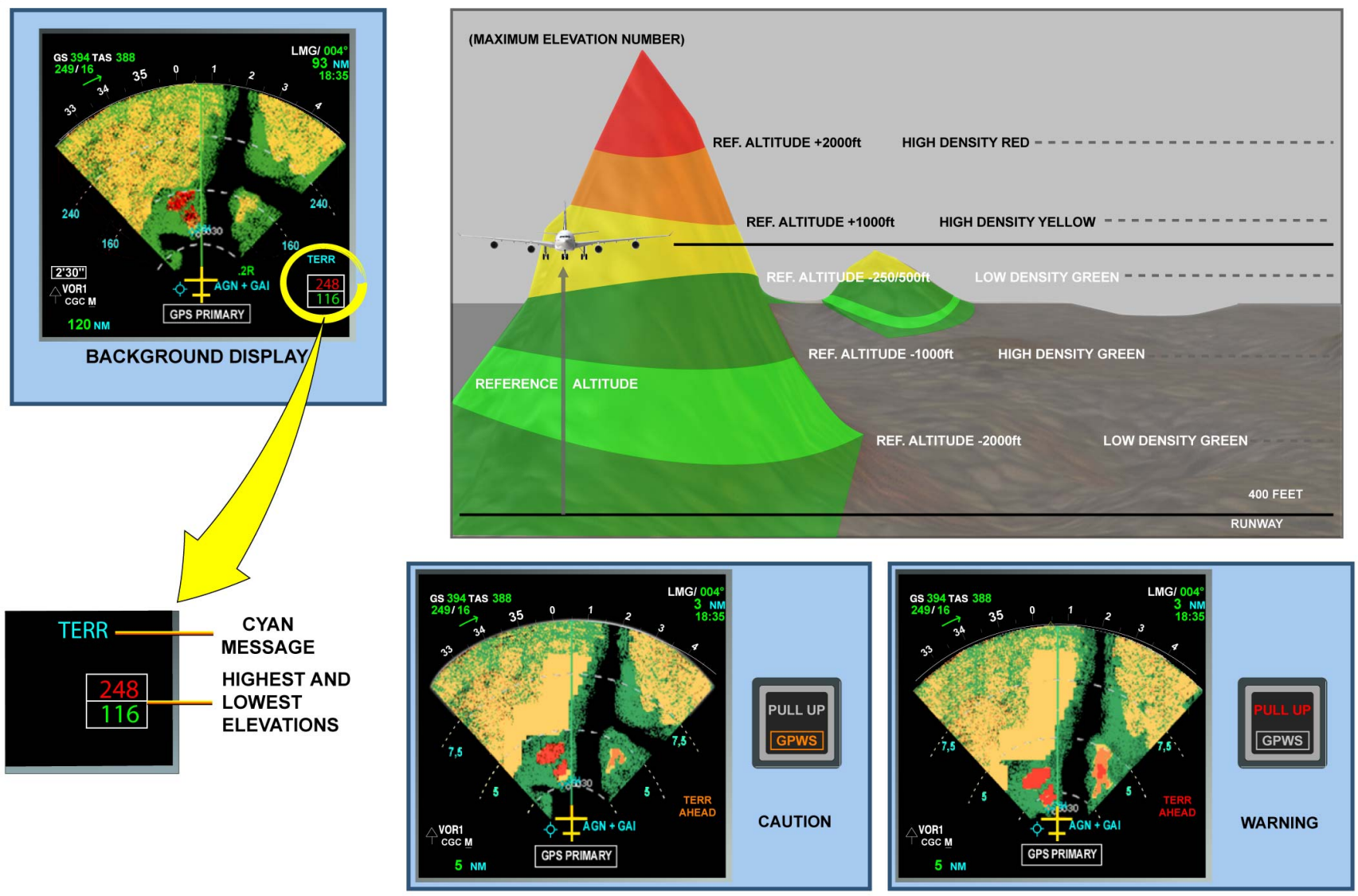

WARNING MODES - TERRAIN AWARENESS AND DISPLAY (TAD): BACKGROUND DISPLAY

TAWS/EGPWS/T2CAS D/O (3)

WARNING MODES (continued)

TERRAIN CLEARANCE FLOOR (TCF)

The Terrain Clearance Floor (TCF) is an increasing terrain clearance envelope around the airport runway to give protection against controlled flight into terrain. The TCF alert function is added to the existing Mode 4. When the TCF alert envelope is entered, "TOO LOW TERRAIN" is broadcasted. It is based on current A/C position, nearest the runway center point position and Radio Altitude (RA).

NOTE: The optional geometric altitude function lets the EGPWS operate reliably throughout extreme local pressure or temperature variations from standard. The optional geometric altitude gives an accurate altitude referenced to Mean Sea Level (MSL). It is based on barometric and GPS altitude, Static Air Temperature (SAT), A/C position, RA height and terrain database.

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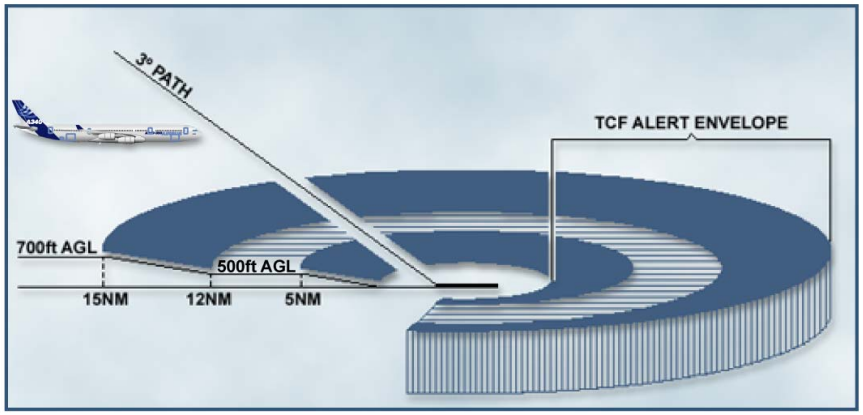
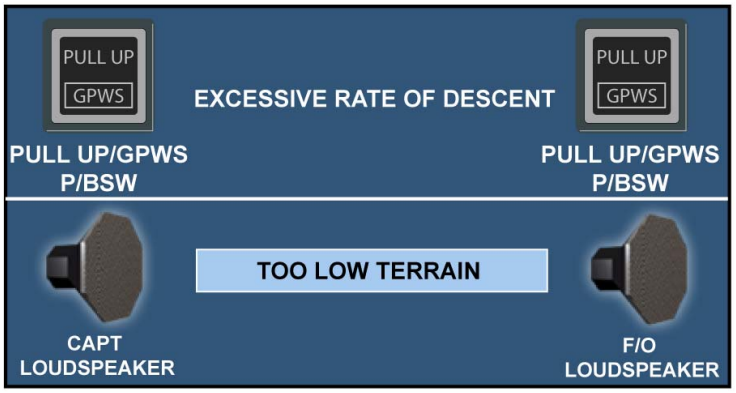
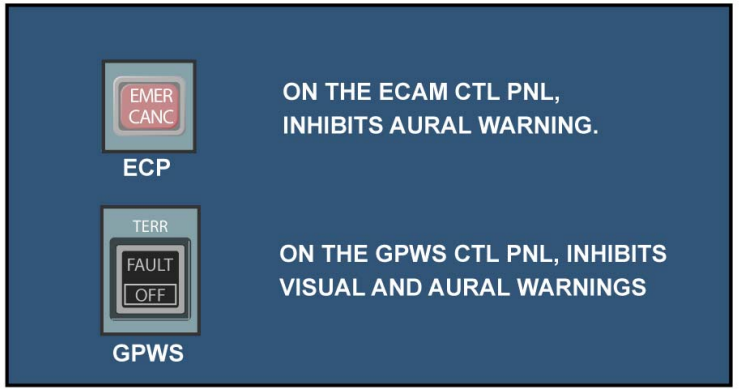


TCF ALERT ENVELOPE

TCF



WARNING INHIBITIONS



WARNING MODES - TERRAIN CLEARANCE FLOOR (TCF)

TAWS/EGPWS/T2CAS D/O (3)

T2CAS

GENERAL

Optionally, the aircraft may have a Terrain and Traffic Collision Avoidance System (T2CAS) installed. The T2CAS is a new system, which replaces the TCAS and the EGPWS. The T2CAS is a combination of two functions in a single Line Replaceable Unit (LRU). These functions are the TCAS (TCAS II Change 7) and the Terrain Awareness and Warning System (TAWS).

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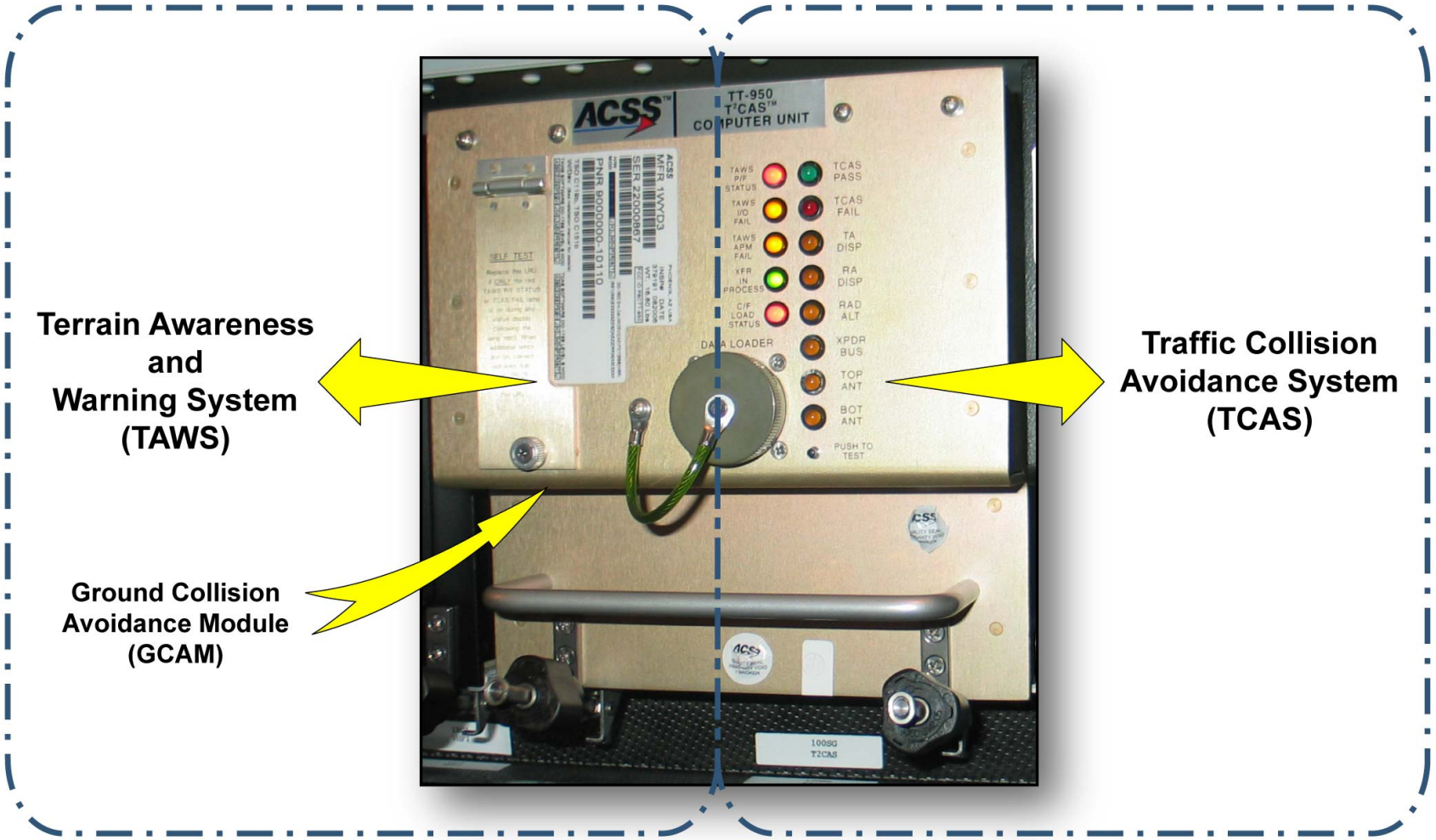
Terrain and Traffic Collision Avoidance System (T2CAS)



T2CAS - GENERAL

TAWS/EGPWS/T2CAS D/O (3)

T2CAS (continued)

FUNCTIONS AND INTERFACES

All cockpit controls and indications (lights, P/BSWs) for the T2CAS-TAWS remain identical to the EGPWS. All EGPWS inputs/outputs are conveyed to the T2CAS as well as a few dedicated T2CAS-TAWS inputs (slat/flap control lever position from SFCC 1 and engine out information from the FMGEC 1). The interfaces are also identical to the TAWS peripheral systems (FWC, DMC, CMC, FDIMU...).
The T2CAS includes partitioned modular functions for both TCAS and TAWS functions. The following alerting functions are integrated in the T2CAS-TAWS part:
- basic GPWS functions (Modes 1 to 5), mainly based on Radio Altitude,
- predictive modes: Collision Prediction and Alerting (CPA) function and Terrain Hazard Display (THD) function, which gives a forward-looking terrain avoidance and premature descent alert functions.

NOTE: The basic GPWS modes 1 and 2 are automatically inhibited when CPA and THD functions are operating. Optionally, an automatic deactivation of predictive function upon navigation high/low accuracy criteria can be activated, if the TAWS logic uses the Flight Management System (FMS) 1 lateral position. When this option is activated, the predictive mode is deactivated if the navigation accuracy is low. The green "TERR STBY" ECAM memo is displayed and mode 1 and 2 are reactivated.

The Ground Collision Avoidance Module (GCAM) ensures a very low rate of nuisance alerts to keep the crew confident in the sent alerts. It addresses some specific situations such as situations of normal aircraft operation according to procedures at altitudes significantly below the surrounding local terrain height (approaches in steep valleys). If GCAM predicts that the A/C can not climb over the terrain with sufficient safety margin:
- the aural "AVOID TERRAIN" warning is triggered,
- visual black crosses are displayed in the solid red on the ND.

NOTE: The T2CAS is not compatible with the weather radar autotilt function.

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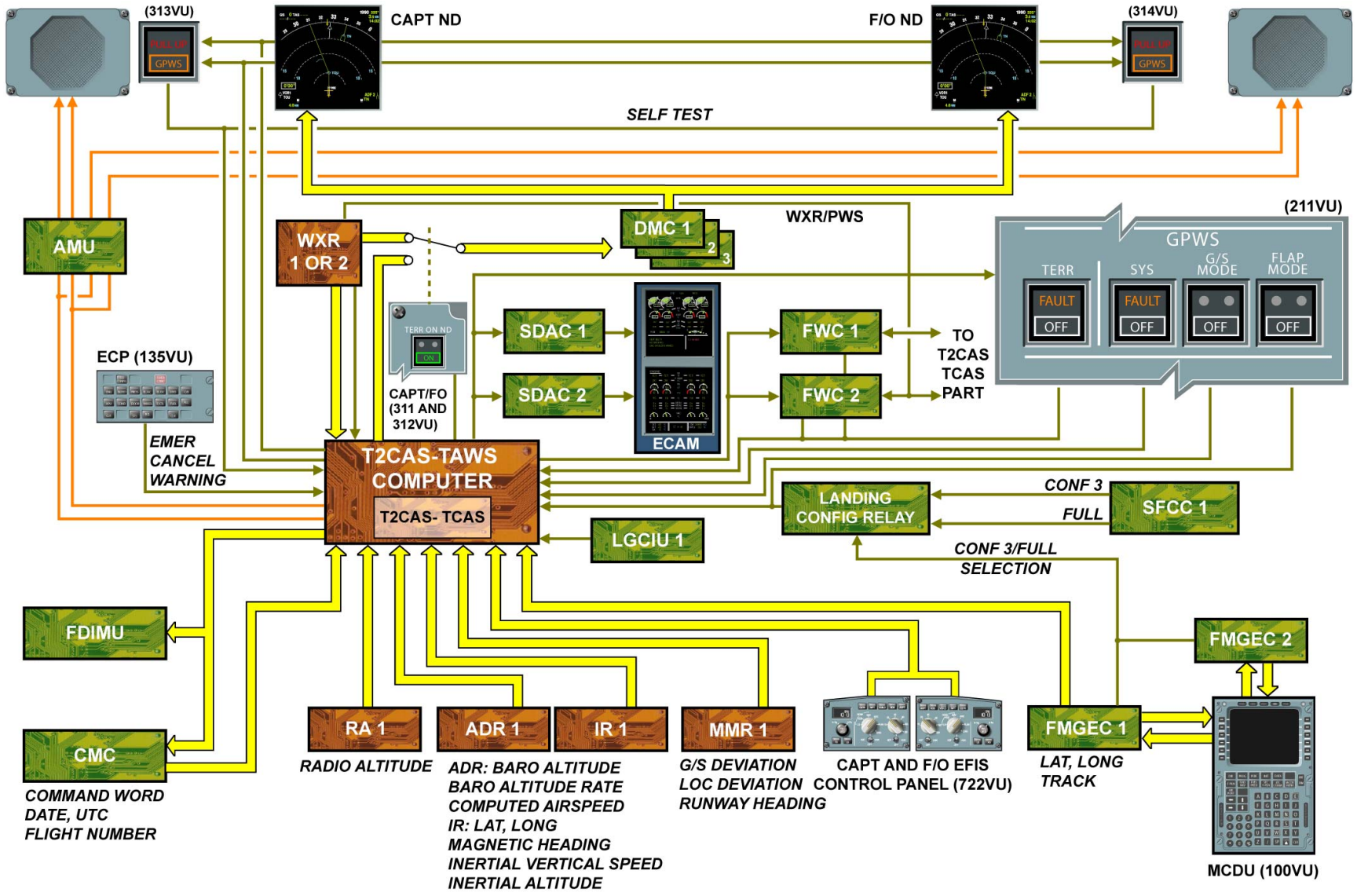

T2CAS - FUNCTIONS AND INTERFACES

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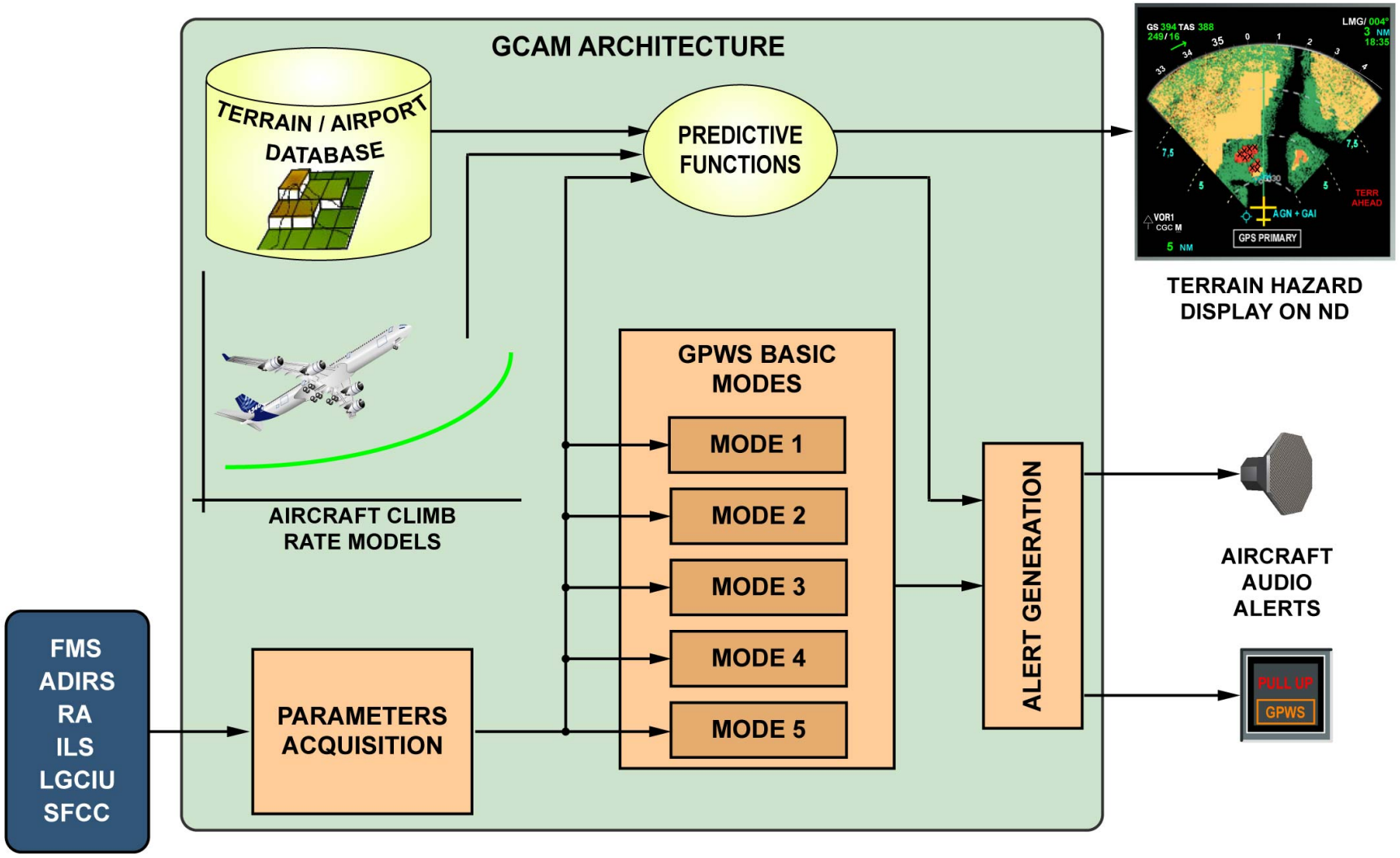

T2CAS - FUNCTIONS AND INTERFACES

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TAWS/EGPWS/T2CAS D/O (3)

T2CAS (continued)

EGPWS/T2CAS DIFFERENCES

The EGPWS and T2CAS have different philosophies. The EGPWS keeps all modes active but desensitizes nuisance prone modes function of the predictive mode (TAD) integrity and aircraft location (through envelope modulation). The T2CAS inhibits the mode 2 when the CPA is in normal operation and the CPA altitude cross check is correct.
The EGPWS sensor includes a vertical margin (terrain floor) function of Vz and Runway proximity. This margin is directly applied on the terrain cells for T2CAS. The EGPWS and T2CAS both use a caution and a warning sensors projected in a terrain database. EGPWS assumed that the A/C could climb 6° all the time. The T2CAS takes into account real time aircraft climb capability to send an alert with guaranteed safety margins. If this safety margin is not sufficient, the AVOID TERRAIN alert is started to indicate to the pilot that a turn maneuver is recommended in addition to the PULL UP warning.
The EGPWS and the T2CAS have very similar display principles (same layer colorations). Both systems give an anticipated background display in descent (approximately 30 sec). The T2CAS has one specific feature, which is the AVOID TERRAIN display.

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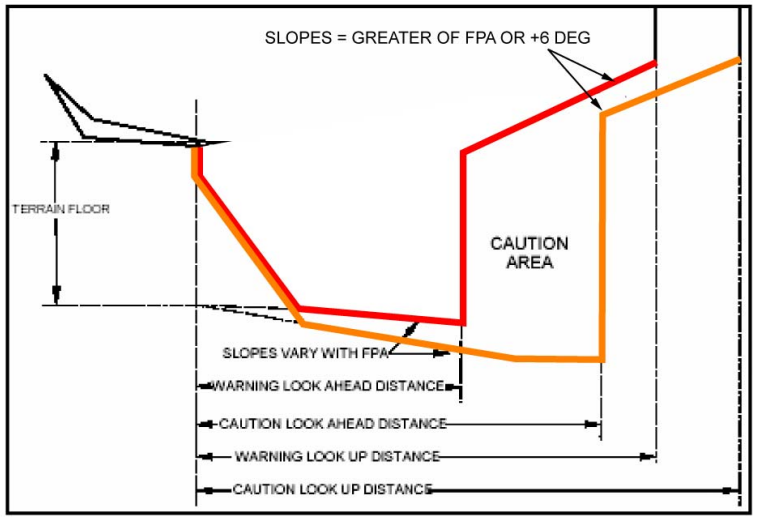
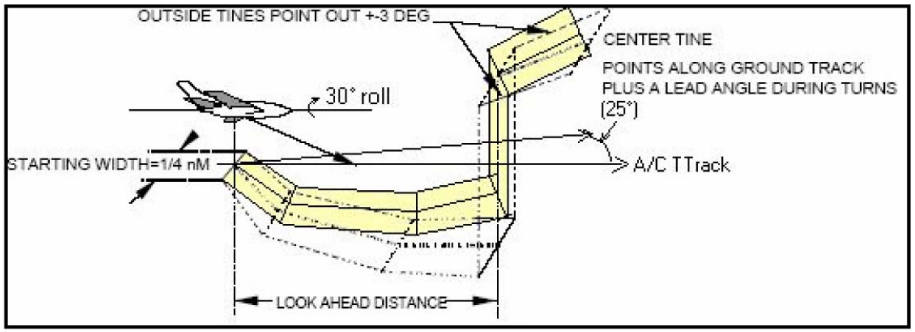
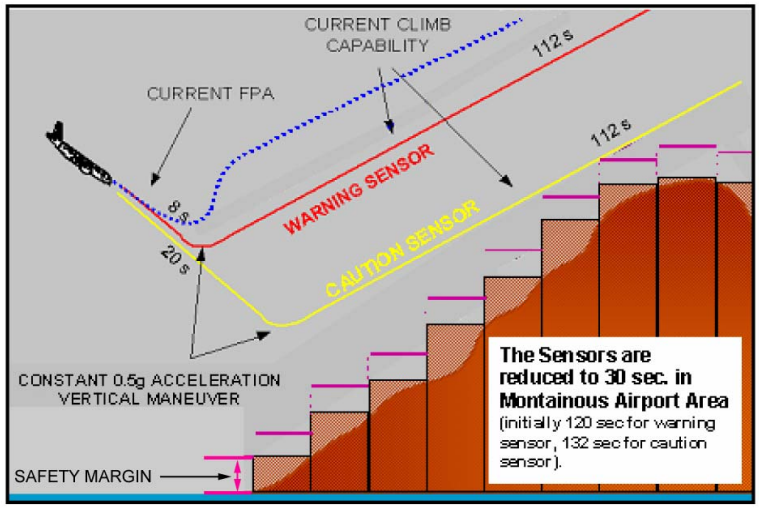
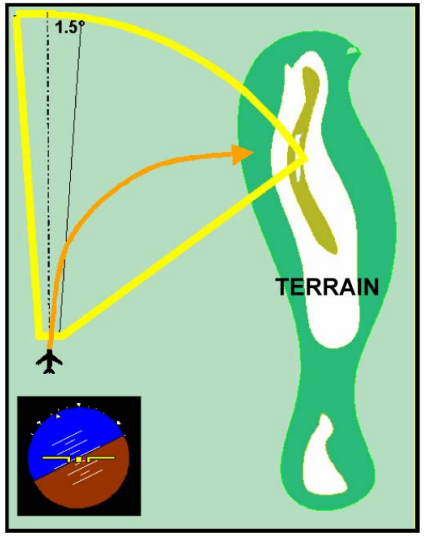
EGPWS


SLOPES = GREATER OF FPA OR +6 DEG
TERRAIN FLOOR
CAUTION AREA
SLOPES VARY WITH FPA
WARNING LOOK AHEAD DISTANCE
CAUTION LOOK AHEAD DISTANCE
WARNING LOOK UP DISTANCE
CAUTION LOOK UP DISTANCE

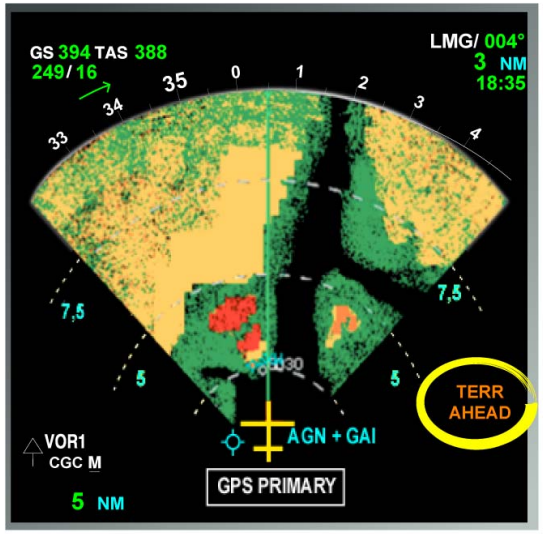


T2CAS



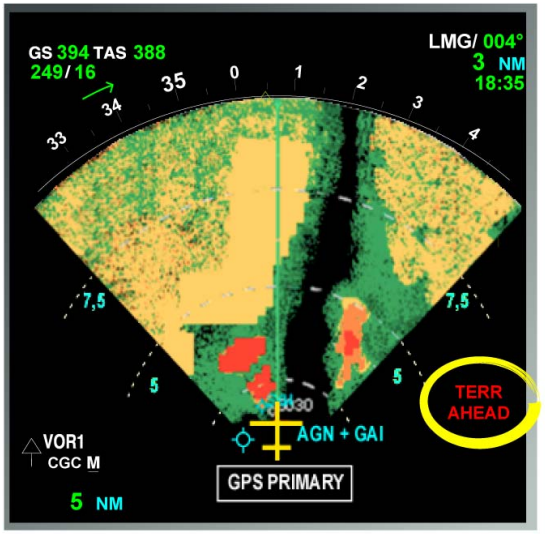


T2CAS - EGPWS/T2CAS DIFFERENCES



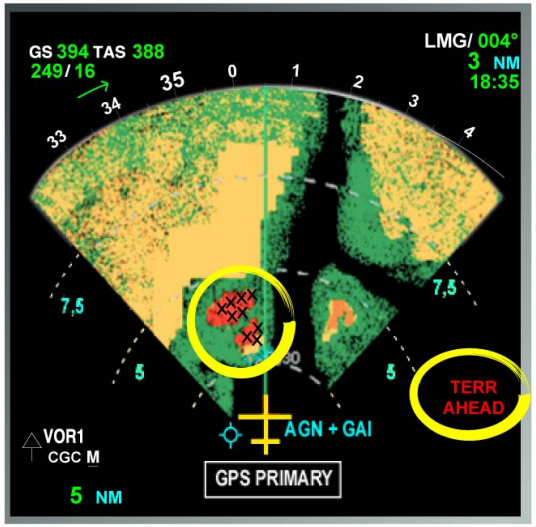
"TERRAIN AHEAD"

CAUTION



"TERRAIN AHEAD, PULL UP"

WARNING



"AVOID TERRAIN"
(PRECEEDED AT LEAST BY "TERRAIN AHEAD, PULL UP")

WARNING

T2CAS - EGPWS/T2CAS DIFFERENCES

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RADIO ALTIMETER D/O (3)

ANTENNAE

The transmission and reception antennae are identical. The frequency range that is used varies from 4200 Mhz to 4400 Mhz. The operating range of the antenna is limited to +30º or -30º for aircraft roll and pitch attitude.

LGCIU

The Landing Gear Control and Interface Unit (LGCIU) provides the flight/ground information, which is used by the receiver BITE module to count the flight legs.

INDICATING

In normal operation, system 1 provides the height data, up to 2.500 feet, for the CAPT PFD, and system 2 for the F/O PFD, through Display Management Computers (DMCs) 1 and 2. When a failure of one transceiver occurs, the DMCs automatically switch over to the other transceiver.

FAN

Each transceiver is cooled by an associated fan. The fan is installed under the transceiver and receives its power, 115 VAC, from the transceiver.

USERS

The Radio Altimeter (RA) information is sent to the Enhanced Ground Proximity Warning System (EGPWS) for different warnings, to the Flight Management Guidance and Envelope Computers (FMGECs) for processing data, to the Flight Warning Computers (FWCs) for call out indications and warnings, and to the Flight Control Primary Computers (FCPCs) for integration into various flight parameters. If the RA 1 system fails the EGPWS no longer receives radio altitude data.

It also sends information to the Traffic Alert and Collision Avoidance System (TCAS) for, triggering of inhibit orders in the 0 to 2.500 ft range and for the system sensitivity, and to the Weather Radar (WXR) transceivers for automatic activation of the predictive windshear function if it is activated.

CMC

The MCDUs allow the systems to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground. Some tests are inhibited on ground by signals coming from the Engine Interface and Vibration Monitoring Unit (EIVMU) when the associated engine is operating.

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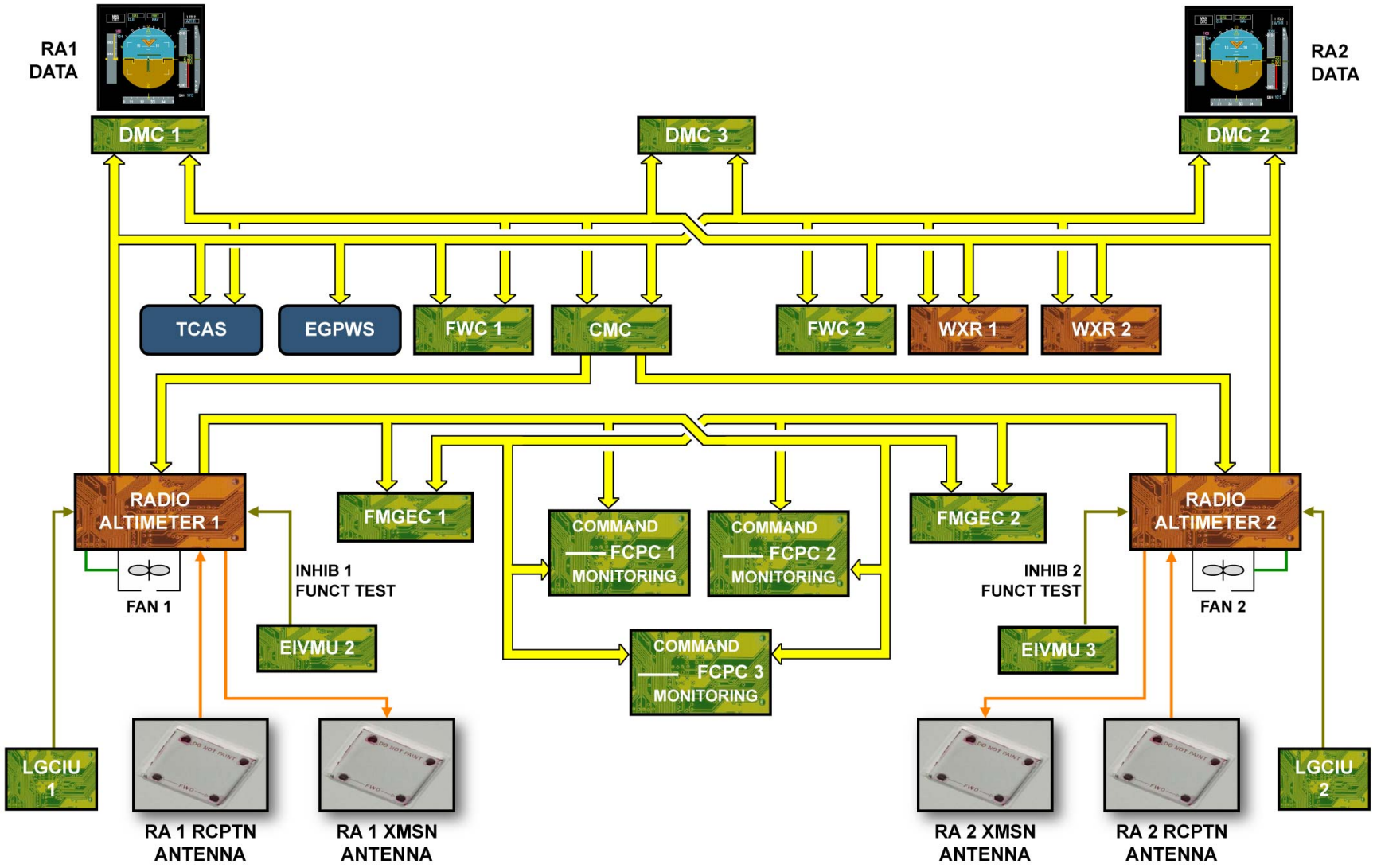

ANTENNAE ... CMC

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WXR/PWS D/O (3)

CONTROL UNIT

The Control Unit (CU) provides mode of operation, antenna tilt and gain of the receiver digitalized information, via an ARINC 429 bus. The transceiver start up system is ensured by a discrete signal. The CU also controls the wave guide switching.

TRANSCEIVER

The Weather Radar (WXR) uses the principle of radio echoing to detect the level of precipitation, and the principle of doppler effect to detect the turbulence areas. The transceiver operates in the x-band frequency (9345 Mhz). It digitalizes the video signal for display on the NDs.

ANTENNA

The WXR antenna is energized and controlled in azimuth and elevation by the transceiver in use. The radio frequency signals are exchanged between the transceivers and the antenna, via a wave guide. The antenna scans a 180º sector in azimuth and has a tilt coverage of + or - 15º. An internal circuit of the transceiver ensures antenna stabilization. The stabilization data are pitch and roll angles, selected tilt, antenna azimuth angle and elevation angle.

WAVE GUIDE SWITCH

The wave guide switch ensures the switching of the RF signal from the antenna to each transceiver. 2 discrete lines are used to avoid transmission on a closed wave guide.

ADIRU

The three Air Data and Inertial Reference Units (ADIRUs) give the pitch and roll angles, to ensure antenna stabilization, and the ground speed for doppler mode correction. The ADIRU, which provides data is selected by means of the Air Data and Inertial Reference System (ADIRS) switching panel.

LGCIU

The Landing Gear Control Interface Unit (LGCIU) sends a discrete signal to the transceiver. This ground/flight information is used by the receiver BITE module to count the flight legs. The L/G extended condition is used to identify a GO AROUND and to allow the audio signal transmission if needed.

INDICATING

The WXR image provided by the selected transceiver, is shown on CAPT and F/O NDs. The video signal is sent to the NDs via the Display Management Computers (DMCs), by means of two ARINC 453 buses. Each data cable is terminated at one end with a low inductance resistor (68 ohms) to avoid a signal return.
The various system controls are grouped on the WXR control unit and on the EFIS control panels of the Flight Control Unit (FCU). On either EFIS control panel of the FCU, the mode selector switch must be set to the ARC or ROSE position to obtain the image display on the corresponding ND.

CMC

The MCDUs allow the systems to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground. Only one transceiver provides information to the NDs at a time, but both transceivers are always supplied in order to achieve the maintenance function (continuous test).

RADAR MULTISCAN MODE (OPTION)

Optionally, the aircraft may be equipped with a multiscan radar transceiver. The multiscan is a radar function that display all significant

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weather at all ranges, at all aircraft altitude and at all times on a display that is essentially clutter-free, without the need for pilots to inputs tilt or gain settings. The multiscan reduces pilot workload, optimizes weather detection and minimizes ground clutter. The multiscan mode manages the antenna beam tilts automatically. The antenna tilts are controlled for optimum weather detection during each flight phase. Two antenna scans are performed, each scan is optimized for a particular region in front of the aircraft. The upper beam detects medium range weather and the lower beam detects short and long-range weather by automatically adjusting tilt and gain.

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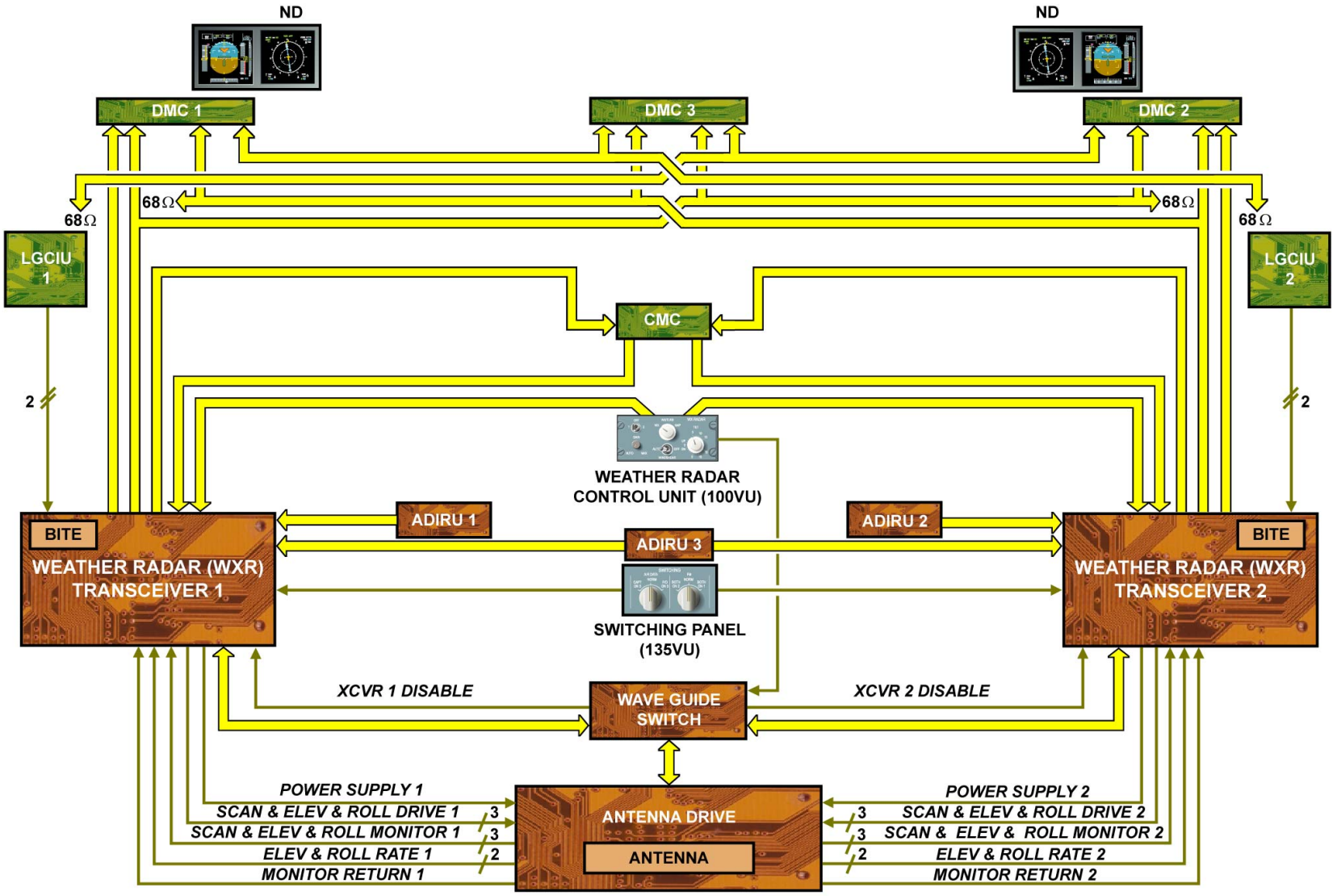

CONTROL UNIT ... RADAR MULTISCAN MODE (OPTION)

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WXR/PWS D/O (3)

PREDICTIVE WINDSHEAR SYSTEM

A discrete input, provided by the WXR CU through the AUTO/OFF switch, enables the windshear function. This discrete signal is also transmitted to the three DMCs which use it for the windshear message display logic.
Two types of qualifier inputs are required to prevent automatic activation of the windshear function:
- qualifiers A1 and A2, coming from the ATC/Traffic Alert and Collision Avoidance System (TCAS) CU,
- and qualifiers B1 and B2, provided by the engine oil pressure sensors of engines.
In order to automatically activate the windshear function, one qualifier A and one qualifier B have to be valid.

NOTE: on the A330, qualifiers B1 and B2, are provided by the engine oil pressure sensors of engines 1 and 2.
on the A340, qualifiers B1 and B2, are provided by the engine oil pressure sensors of engines 2 and 3.

The RA provides the transceiver with altitude data, which is used for the automatic activation of the windshear function. An analog audio output transmits a synthetic voice alert message to the Audio Management Unit (AMU).
Audio inhibit discrete signals are used to indicate whether the aural alert output has to be active or not. The audio input discretes are used to inhibit the predictive windshear alerts. The predictive warning system audio inhibit discrete ouputs are used to inhibit other aural alerts generated by systems such as TCAS or Enhanced Ground Proximity Warning System (EGPWS), or other Flight Warning Computer (FWC) warnings.

AUTO-TILT FUNCTION (OPTION)

The Auto-Tilt Function in an option of the weather radar system. It optimizes the weather detection to minimize ground clutter and data correlation with radar returns.
The method for minimizes ground clutters is based on the utilization of the terrain altitude information from the EGPWS Database.
The EGPWS determines the optimum tilt angle for the radar according to the aircraft altitude above the terrain, the range selection and the terrain condition in the area.

NOTE: The Radar control panel with this option is not compatible with the installation of a T2CAS

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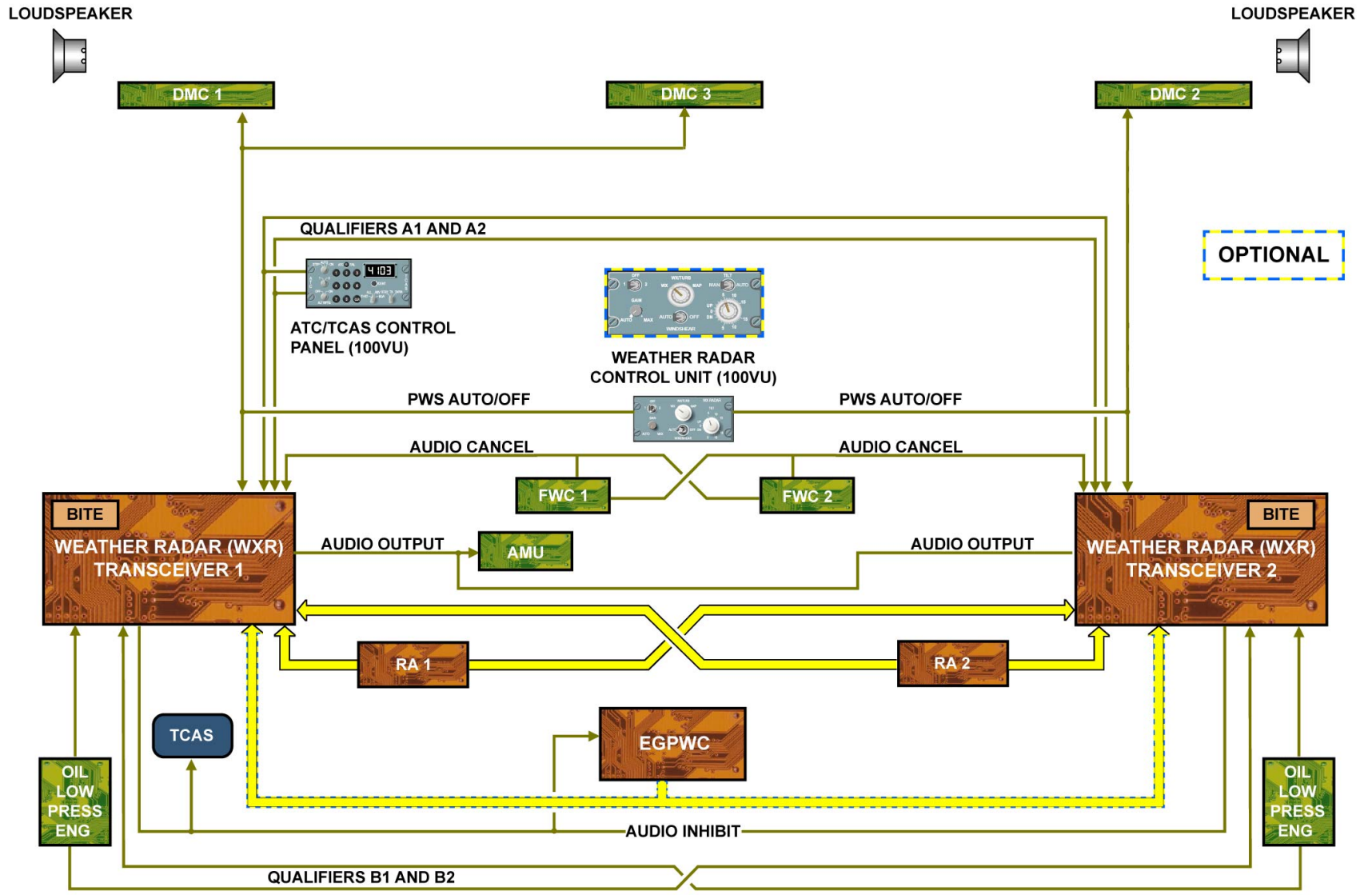

PREDICTIVE WINDSHEAR SYSTEM & AUTO-TILT FUNCTION (OPTION)

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ATC/TCAS D/O (3)

TCAS PRINCIPLE

The Traffic Alert and Collision Avoidance System (TCAS) detects and displays aircraft in the immediate vicinity and provides the flight crew with indications to avoid these intruders by changing the flight path in the vertical plan only. The first aircraft to detect the other one initiates the communication procedure and indicates the maneuver to perform. The TCAS will generate two types of warnings: the Traffic Advisories (TA) and the Resolution Advisories (RA).

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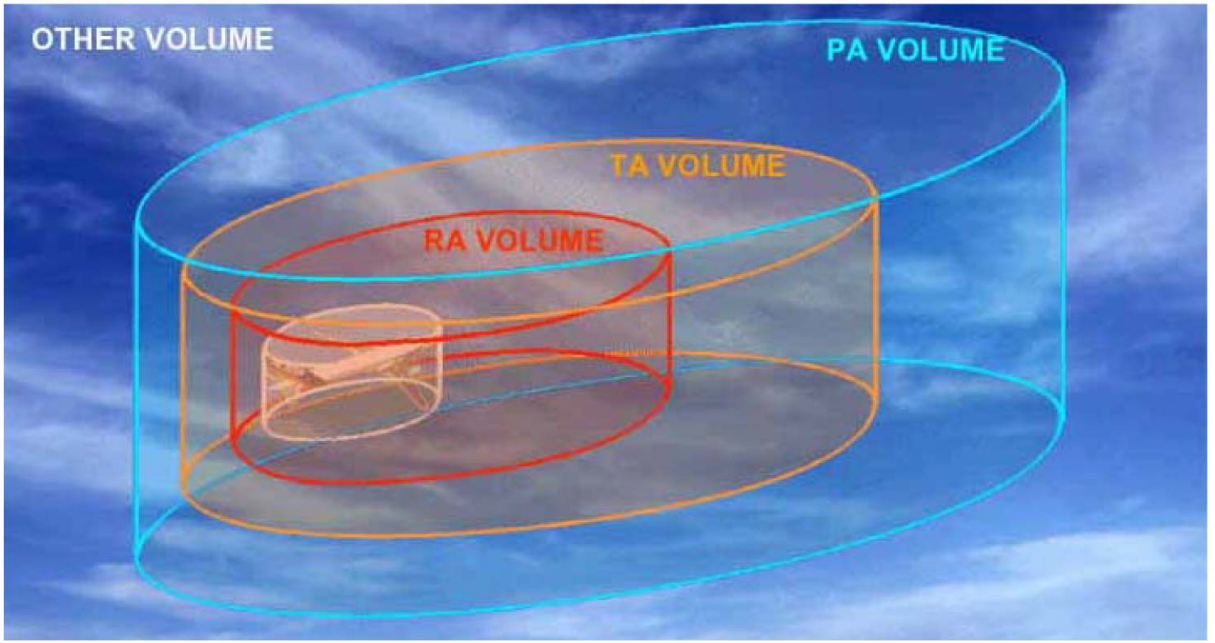


DETECTION VOLUME	INTRUDER POSITION	INFORMATION DISPLAYED
Other intruders	No collision threat, closer than 30 Nm	On ND, intruder position
Proximate (PA)	No collision threat, closer than 6 Nm in lateral and +/- 1200 ft in vertical	On ND, intruder position
Traffic Advisory (TA)	Potential collision threat	On ND, intruder position and aural messages
Resolution Advisory (RA)	Real collision threat	On ND, intruder position, aural messages and avoidance maneuver orders on PFD

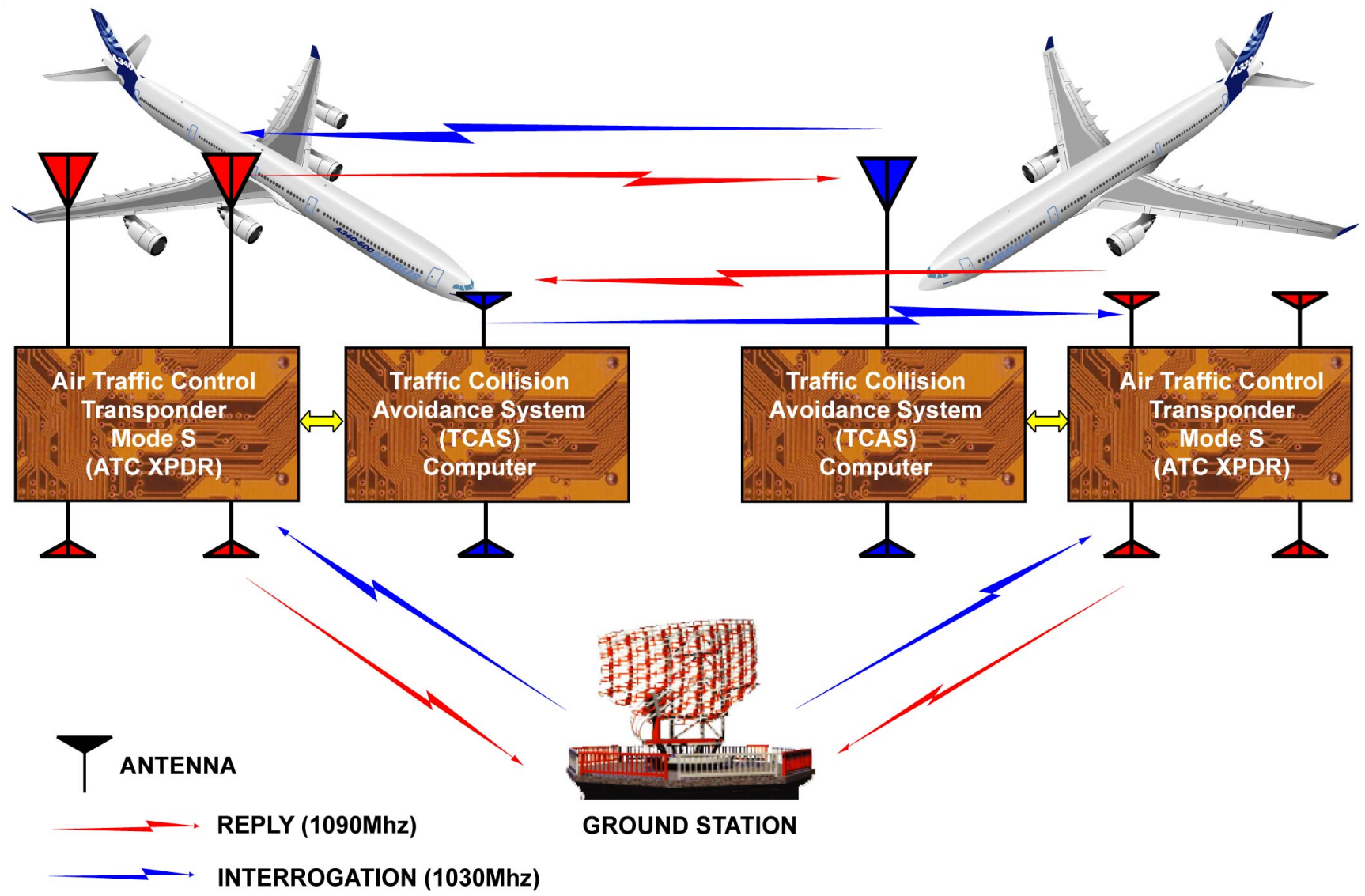
TCAS PRINCIPLE

G9409341 - GAUT0T0 - FM34D0F34CC0102

ATC/TCAS D/O (3)

ATC/TCAS OPERATION

The TCAS periodically transmits interrogation signal for all ATC ground station and mode S transponder equipped aircraft in the vicinity. In response to these interrogations, the transponders of nearby aircraft return signals containing their altitude value. The TCAS computes the range between the two aircraft by measuring the elapsed time between transmission of the interrogation and reception of the reply.


Air Traffic Control Transponder Mode S (ATC XPDR)
Traffic Collision Avoidance System (TCAS) Computer
Traffic Collision Avoidance System (TCAS) Computer
Air Traffic Control Transponder Mode S (ATC XPDR)
ANTENNA
REPLY (1090Mhz)
INTERROGATION (1030Mhz)
GROUND STATION

ATC/TCAS OPERATION

G9409341 - GAUT0T0 - FM34D0F34CC0102

ATC/TCAS D/O (3)

ATC ANTENNAE

The Air Traffic Control (ATC) antennae transmit replies to interrogations from ATC ground stations or Traffic Collision Avoidance System (TCAS) equipped A/C. The transponder switches between top and bottom antennae according to the characteristics of the received signals. The ATC antennae receive at 1030 MHz and transmit at 1090 MHz. Each second a squitter message is transmitted alternatively by the top and bottom antennae.

TCAS ANTENNAE

The TCAS has two antennae for transmission and reception. The TCAS switches reception and transmission circuits between the top and bottom antennae. The TCAS antennae transmit at 1030 MHz and receive at 1090 MHz. Communications between two A/C are always crossed between transponders and TCAS: TCAS to ATC, then ATC to TCAS. The antennae provide azimuth information on aircraft located within the TCAS surveillance range.

ATC/TCAS CONTROL PANEL

A unique ATC/TCAS control panel controls both systems. The ATC transponder is directly controlled, and the TCAS computer is controlled through the ATC transponder. On one hand the ATC/TCAS control panel receives monitor lamps discrete signals from the ATC transponder and AIR/GROUND discrete signals from the Landing Gear Control and Interface Unit (LGCIU). On the other hand it sends AIR/GROUND and STBY/ON discrete signals to ATC transponders.

NOTE: According to your aircraft configuration, the ATC/TCAS control panel may be different. The ATC/TCAS control panel with keyboard can be replaced by the ATC/TCAS control panel with rotary switches, which give the possibility to activate the "full time display" and "above/below" functions.

ATC TRANSPONDER

Various systems provide data to the transponder. Air Data Inertial Reference Units (ADIRUs) 1 and 2 provide baro altitude to their associated transponders. ADIRU 3 is in standby and will be used according to the AIR DATA switch status. In normal operation, one ATC transponder is operating as the other one is in standby.
The Flight Management Guidance and Envelope Computers (FMGECs) provide flight identification. This data will be transmitted to an ATC ground station after a mode S interrogation. The LGCIUs provide ground/flight data to the ATC/TCAS control panel for AUTO mode of ATC transponder and BITE purposes. As ATC, TCAS and Distance Measuring Equipment (DME) operate in the same frequency range, a suppressor signal is transmitted by the operating system to inhibit the other systems and to prevent simultaneous transmission.

NOTE: The interfaces between the ATC and the Air Traffic Service Unit (ATSU), the Flight Control Unit (FCU) and the Inertial Reference (IR) part of the Air Data/Inertial Reference Unit (ADIRU) are installed for enhanced surveillance/extended squitters.

TCAS COMPUTER

Various systems give data to the TCAS computer. ADIRU1 gives heading, pitch and roll data. FMGEC1 gives A/C performance limitations for resolution advisory computation. The Radio Altimeters (RA) gives radio altitude, which is mainly used in sensitivity level computation. One RA signal is used as the other one is in standby. LGCIU1 gives ground/flight and L/G extended data for TCAS operation and BITE functions.
TCAS RA triggers automatically the Flight Director and Autopilot Mode (AP/FD TACS Mode)

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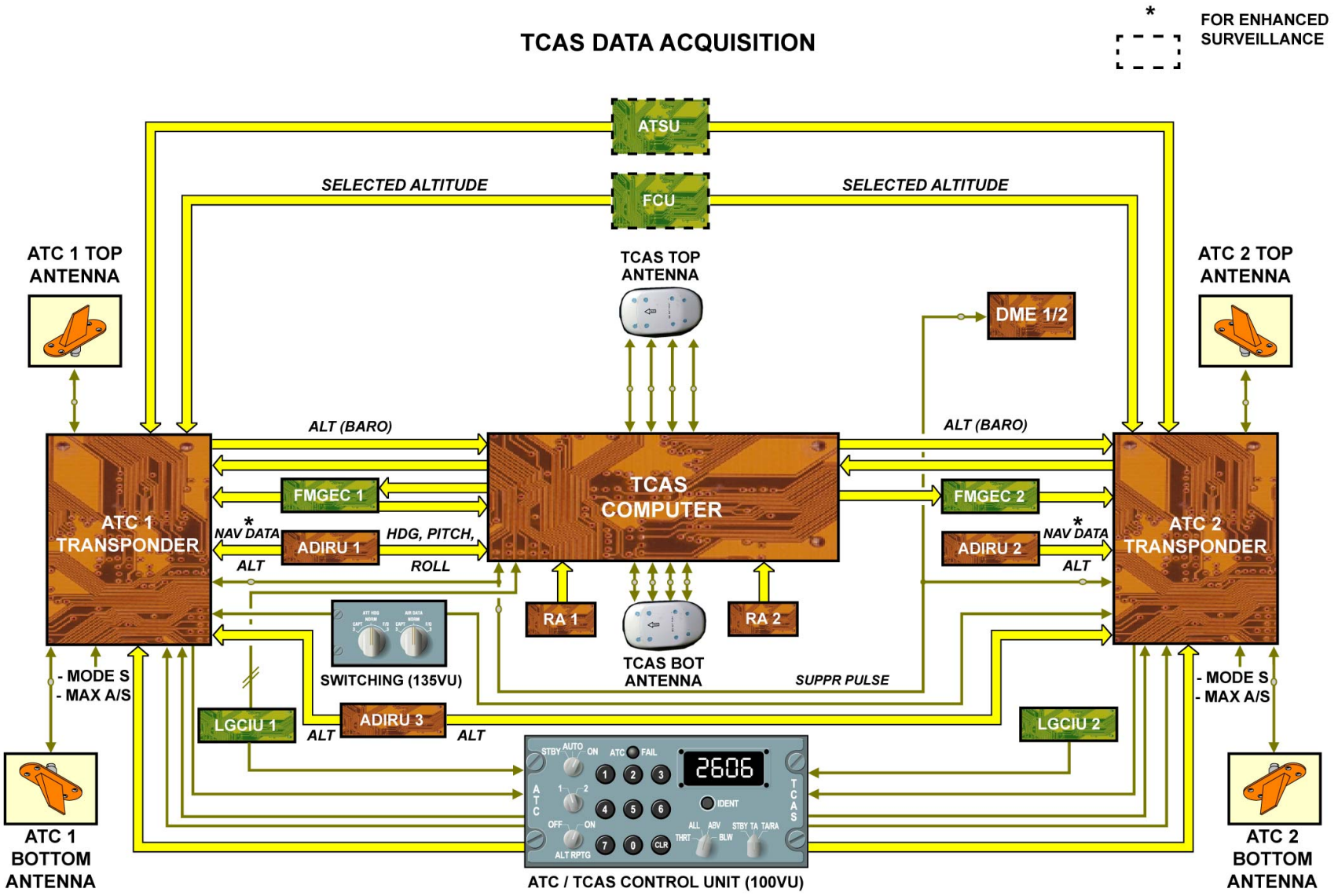
ATC/TCAS LINK

The operative ATC transponder transmits data to the TCAS such as baro altitude, TCAS controls from the control panel, TCAS BROADCAST MESSAGE received and coordination messages during a coordinated resolution advisory. The TCAS transmits data to the ATC transponder to reply to a mode S interrogation and coordination messages during a coordinated resolution advisory.



ATC ANTENNAE ... ATC/TCAS LINK

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ATC/TCAS D/O (3)

TCAS INDICATING

The TCAS gives visual data on PFDs and NDs. The NDs give indication on the location of intruders. The PFDs give to the flight crew vertical speed correction data to avoid the intruders (corrective and preventive). The Flight Warning Computers (FWCs) check the signal validity. A synthesized voice generator transmits messages from a Read Only Memory to generate aural advisories through the Audio Management Unit (AMU). The display is authorized in three possible ranges (relative altitude):
- above: - 2700 ft to 9900 ft,
- below: -9900 ft to 2700 ft,
- normal: -2700 ft to 2700 ft.

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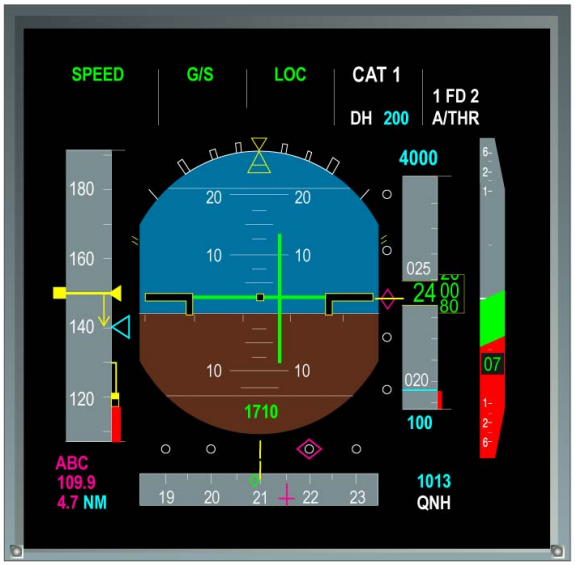
PFD



ND

FORBIDDEN
Vertical Speed (V/S)

"FLY TO"
Vertical Speed (V/S)

LOUDSPEAKERS

INTRUDERS

OTHER TRAFFIC

PROXIMATE TRAFFIC

TRAFFIC ADVISORY

RESOLUTION ADVISORY

TCAS INDICATING

ATC/TCAS D/O (3)

TCAS INHIBITION

Systems with higher priority than TCAS can inhibit advisories via discrete lines, they are:
- windshear/stall warnings from FWCs,
- Predictive WindShear (PWS) through a discrete line from Radars.
- warnings from the Enhanced Ground Proximity Warning System (EGPWS) through 2 discrete lines,

CMC

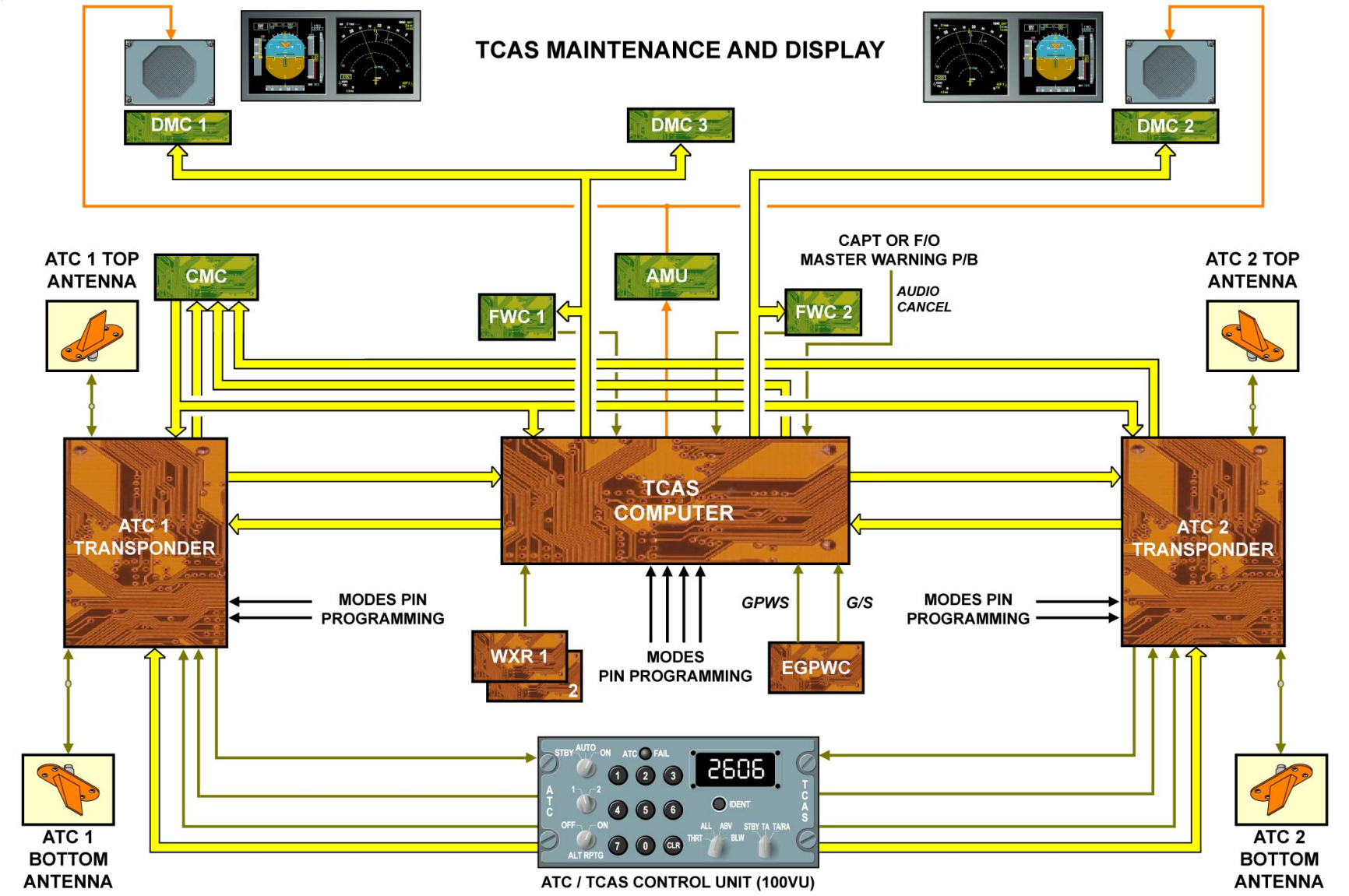
The MCDUs allow the ATC system and TCAS to be tested via the Central Maintenance Computer (CMC). The tests are only available on ground.

PIN PROGRAMMING

Some pin programs define the operating mode of ATC transponders and TCAS computer. The following ATC discrete pin program inputs are used:
- mode S address,
- A/C maximum airspeed.

The following TCAS discrete pin program inputs are used:
- audio level output (high or low),
- number of intruders displayed,
- A/C altitude limit, ground display mode (traffic advisory only),
- proximate A/C displayed only when traffic advisory or resolution advisory occurs.

G9409341 - GAUT0T0 - FM34D0F34CC0102



TCAS INHIBITION ... PIN PROGRAMMING

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ATC/TCAS D/O (3)

T2CAS

GENERAL

Optionally, the aircraft may be equipped with the Terrain and Traffic Collision Avoidance System (T2CAS). The T2CAS is a new system, which replaces the TCAS and the EGPWS. The T2CAS is a combination of two functions in a single Line Replaceable Unit (LRU). These functions are the TCAS (TCAS II Change 7) and the Terrain Awareness and Warning System (TAWS).

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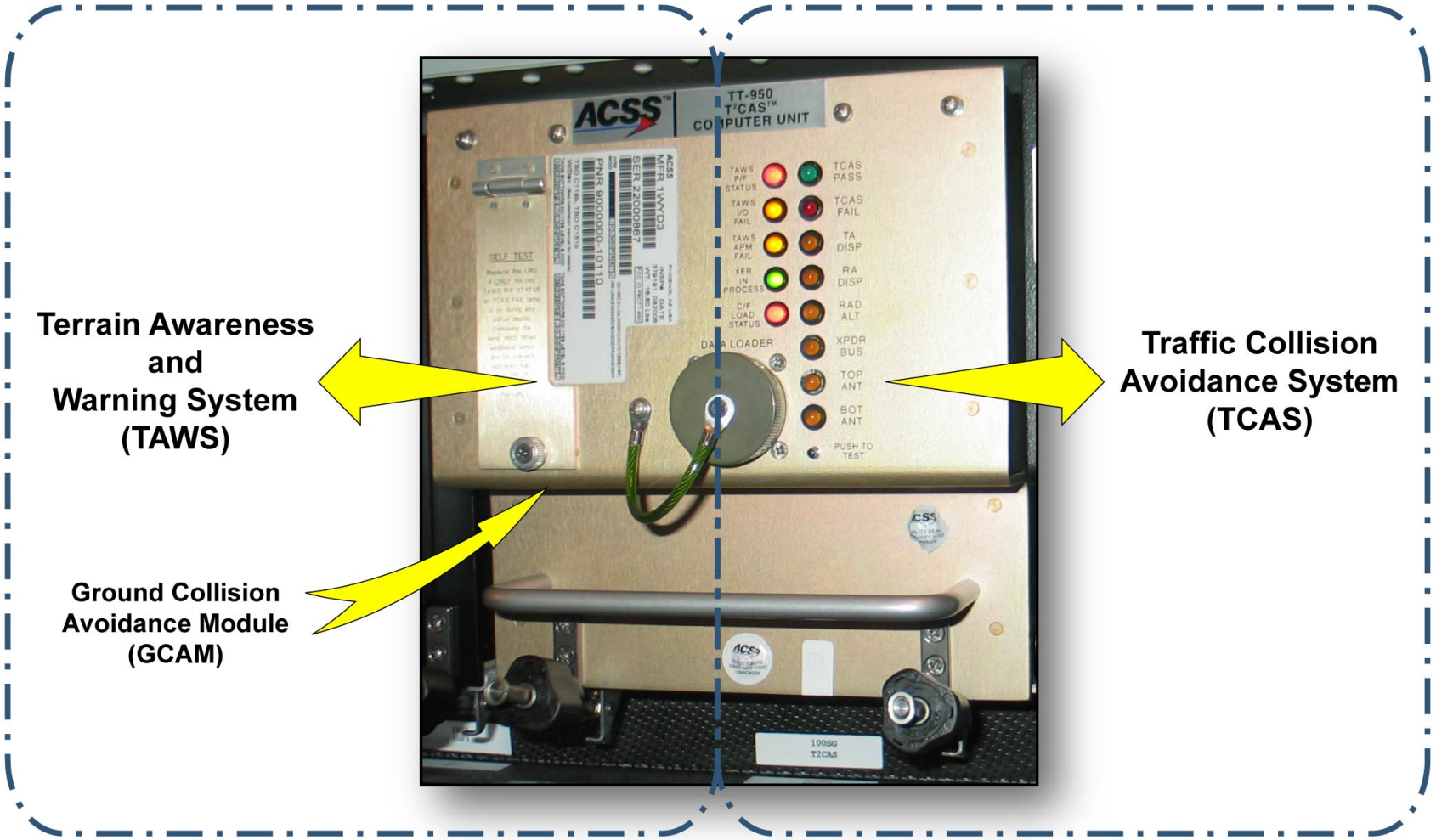
Terrain and Traffic Collision Avoidance System (T2CAS)



T2CAS - GENERAL

ATC/TCAS D/O (3)

T2CAS (continued)

FUNCTION AND INTERFACES

The T2CAS-TCAS function is equivalent to the TCAS II Change 7. The interfaces are also identical, except for the TCAS advisories inhibition done by the TAWS-part of the T2CAS through discretes looped at the back of the computer.

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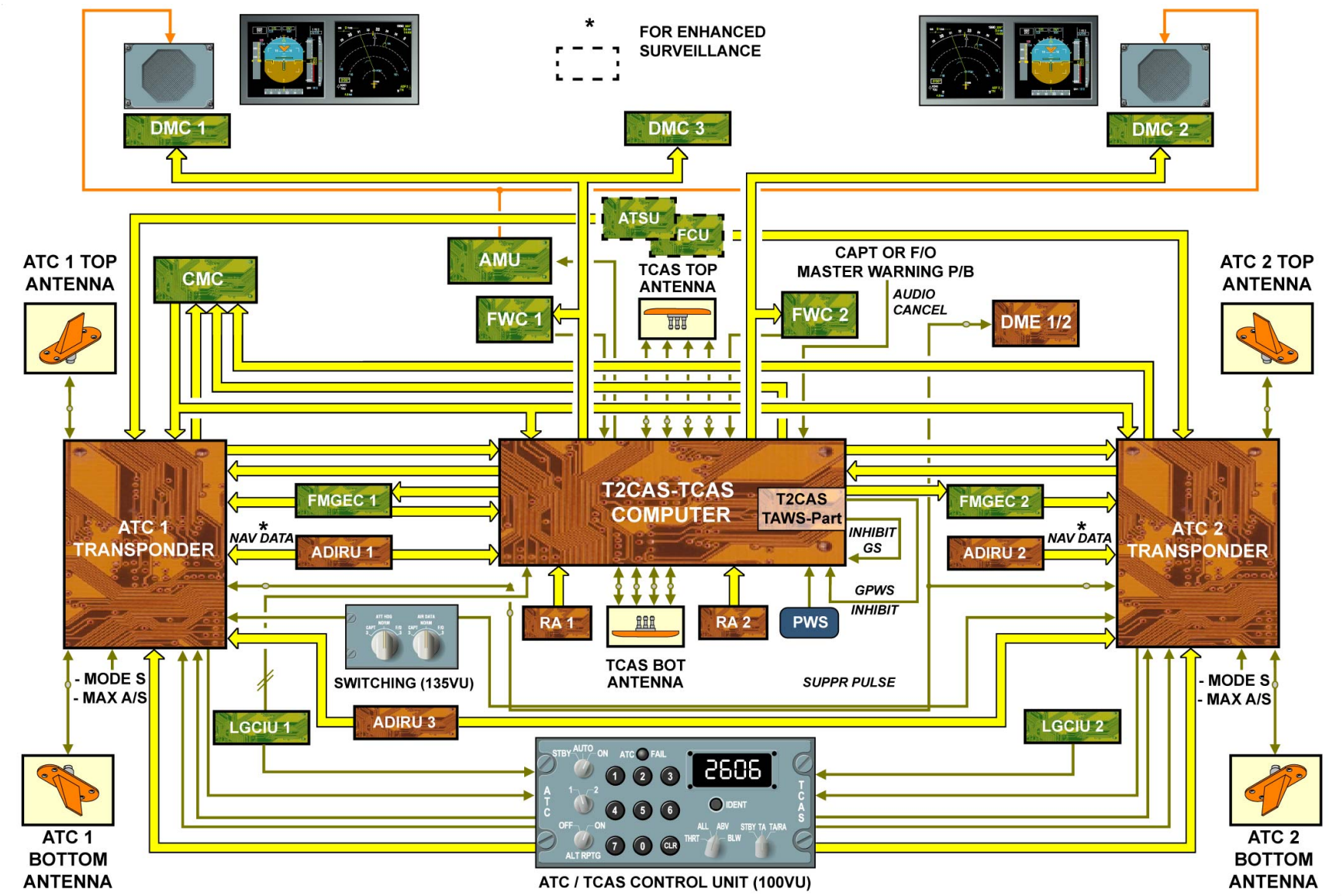

T2CAS - FUNCTION AND INTERFACES

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AIRBUS

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